

CD ROM : VENDORS AND SERVICES

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CD ROM: Vendors and Services

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CD ROM: VENDORS AND SERVICES

ABSTRACT

This is the third volume in a multiclient study of the impact of CD ROM on information services vendors.

- Volume I, CD ROM: Market Overview, examines the technology, main industry markets, and application markets and gives overall strategic recommendations.
- Volume II, CD ROM: User Applications, deals with the current views and plans of Fortune 1000 companies with respect to implementing and using CD ROM applications.
- Volume III (this volume) is a survey of hardware suppliers, CD ROM vendors, distributors, and information services vendors analyzing their products, services, plans, and expectations. It also provides forecasts of market sizes to 1991.

This report contains 103 pages, including 36 exhibits.

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CD ROM: VENDORS AND SERVICES

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I INTRODUCTION

I INTRODUCTION

A. BACKGROUND

- In the last year CD ROM has emerged as a cost-effective alternative to a number of historic-file-storage and reference-file-storage applications that are either currently handled by paper or by magnetic storage (computer output microfilm, tape, diskette, and disk).
- CD ROM has appeared at a time when other optical storage alternatives are already in the process of emerging from the laboratory into early production (e.g., direct read after write (DRAW) drives that have one gigabyte of storage and can be used in "limited write, mostly read" type applications) and when earlier videodisk/laserdisk options are rapidly dying out.
- It is unlikely that CD ROM will disappear quickly, however, since:
 - There are a number of large hardware manufacturers that have made a substantial commitment to CD ROM production (e.g., Hitachi, Alcatel, Thomson, Philips, Sony).
 - CD audio disks, which are based on the same physical media, are experiencing an enormous success which has only just begun to take off.

- CD ROM with voice-over commentary of the stored digital images or image/text has significant attractions for a number of specific applications (e.g., education, insurance, banking, government).
- The cost of CD ROM has only just begun to drop, so that, as economic as it already is, CD ROM will become even more attractive over the next two years.

B. SCOPE

- This is the third volume in a series of three CD ROM-related studies that form part of a 1986 study on the impact of CD ROM on information services.
 - Volume I, CD ROM: Market Overview, has already been published (July 1986) and examines the technology, main industry markets, and application markets, providing market forecasts and overall strategic recommendations.
 - Volume II, CD ROM: User Applications, will be published in October and deals with the current views and plans of Fortune 1000 companies with respect to CD ROM. It analyzes their needs now and in the future and covers purchasing plans.
- This volume (Volume III) is a survey of hardware suppliers, CD ROM vendors, distributors, and information services vendors with an analysis of their products, services, plans, and expectations.
- INPUT has undertaken this study on CD ROM because of the potential impact on existing information services markets and the need to evaluate CD ROM's implications for short- and long-term planning. Potentially, the impact is very broad and could affect every facet of the information services business.

- In 1983 INPUT conducted a study on the impending arrival of optical memory systems and concluded that information systems managers, as well as information services vendors, were largely unprepared for implementing optical storage systems. For the most part, this continues to be the case.

C. METHODOLOGY

- In July 1986, INPUT interviewed 39 information services and CD ROM vendors to ascertain their views and plans for CD ROM. The list of vendors interviewed is provided in Exhibit I-1. For the most part, a structured questionnaire was used (see Appendix B). In some cases (usually where intense CD ROM planning and development was underway) an unstructured, free-form discussion was used.
- In general, the vice president of marketing or equivalent function was contacted. In almost every case it was simple to determine if serious attention was being paid to CD ROM.
 - Where only a superficial knowledge or understanding of CD ROM existed, the market impact was seen as being broad but non-specific.
 - Where a clear, precise knowledge of CD ROM existed, applications or narrow vertical markets were named as opportunities or threats to existing services and products.
- As part of this study, nearly 60 end users were interviewed, predominantly from the Fortune 1000 group of companies. Where relevant, the analysis of that data has been included in this study.
- Forecasts of market growth and size through 1991 were based on:

EXHIBIT I-1

VENDORS INTERVIEWED

VENDOR	Hardware Vendor	Processing Services	Software Products	Turnkey Systems	Professional Services
3M	X				
ADP		X	X	X	
Ashton -Tate			X		
Borland			X		
Boeing Computer Services		X	X	X	X
Computer Consoles				X	
Computer Task Group				X	X
Control Data Corp.	X	X	X	X	
Datext			X		
Dialog Info. Services		X			
Daisy Systems				X	
Data Copy		X			
DEC	X		X	X	
Disclosure		X			
EDS		X	X	X	X
Gerber Scientific				X	
Grolier Inc.				X	
Integrated Solution				X	
Interactive Video	X				
Innovative Data	X				
KnowledgeSet			X		
Lotus Development			X		
Laser Drive	X				
Laser Master					
McGraw-Hill		X	X		
Microsoft			X		
NCR	X	X	X		
Newsnet		X			
OCLC		X			
PC Sig			X		
PRC				X	X
Philips	X				
Quantum Access	X				
Reynolds & Reynolds	X			X	
Reference Technology	X		X		X
SPCS	X				
TMS Inc.	X				
TELEX	X				

- INPUT's annual forecast of information services markets is a part of the Market Analysis and Planning Service (MAPS) series of reports.
- INPUT's annual analysis of the information services vendor community (annual performance, growth, and trends).
- As usual, INPUT welcomes reader comments and inquiries which should be addressed to Graham Kemp, Vice President, INPUT, 1943 Landings Drive, Mountain View, CA 94043 or by phoning (415) 960-3990.

II EXECUTIVE SUMMARY

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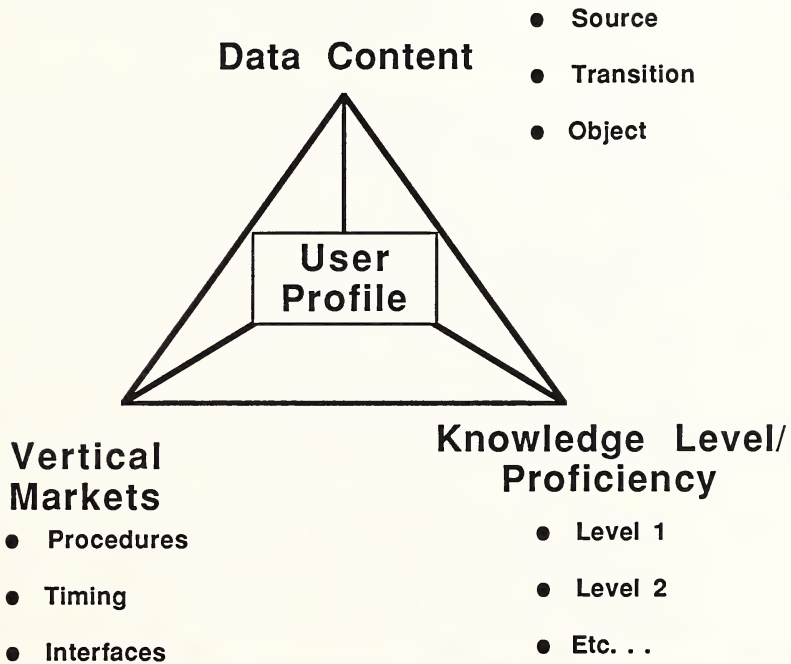
II EXECUTIVE SUMMARY

- This Executive Summary is designed to help the busy reader quickly review the research findings of this report without having to delve into each section. Each of the key points is summarized as an exhibit with an accompanying script on the left-hand page. This format is designed to facilitate use of the Executive Summary as an in-house overhead presentation.
- The use of CD ROM in existing markets and applications is the highest potential for CD ROM in the near term. Information services vendors are cautiously entering these markets with CD ROM adaptations of existing products rather than creating new markets, but new services and products will be significant in revenue earning potential over the next five years.
- CD ROM is already being challenged in the laboratory (though not yet in the marketplace) by derivative technologies that overcome some of CD ROM's shortcomings. For example, WORM (write once, read many times) and DRAW (direct read after write), not to mention fully erasable optical disks, are all practical realities. However, CD ROM offers tangible advantages over these products and represents a quantum leap forward in distributed storage systems.
- The key to CD ROM markets is the detailed understanding of users' needs, work habits, and jargon. Without this understanding the market potential will not be fully exploited.

A. CD ROM APPLICATIONS

- To a degree rarely found elsewhere, CD ROM applications, if they are to be successful, require the integration of three specific levels of knowledge (see Exhibit II-1):
 - Data content: availability of all of the data elements that are necessary to support the activity, both source (original data), transitory (work-in-progress data), and object (results); preferably, the data (particularly source data) should be owned by the CD ROM service vendor or at least obtainable under a long-term contract.
 - Vertical market: understanding the precise workings (procedures, timing, interfaces, etc.) of the work elements associated with a specific profession or activity in order to usefully model an application on a computer system.
 - Knowledge level/proficiency: awareness of the different levels of proficiency that the computer will encounter in users of the service/product.
- The way in which the above three factors need to be brought together is determined by the specification of the user profile which integrates all three into a unique combination, determining the characteristics of the service/system to be offered by the information services vendor. Note that it is perfectly feasible for one set of data to support a number of specific vertical market applications, since they can be differentiated by the software resident on the PC/mini/mainframe processor.

CD ROM APPLICATIONS



B. CD ROM MARKETS ARE SOFTWARE DEPENDENT

- CD ROM, although a storage medium, is identical to the PC in one fundamental aspect--its success is dependent on the rapid proliferation and wide availability of a broad spectrum of systems and applications software. Without such software there can be no exploitation of available markets. If the market penetration does not happen, new technologies will gradually erode CD ROM's potential.
- Also, like the PC, CD ROM's greatest opportunities lie in the business market rather than the consumer market. (The compact disk may be a consumer success, but CD ROM will not be). To date the specific, user profile-oriented systems and applications software required for CD ROM's success are not available (see Exhibit II-2).
- What is available are various types of "generic search" software with customization capabilities. Generally speaking, the development of a CD ROM application requires substantial customized effort rather than relying on standard search/retrieval software.
- However, as soon as recording format standards become normalized, there will be ample opportunity for systems software companies to develop data base management packages capable of handling the highly structured index-oriented formats of CD ROM disks with their concomitant and very large file sizes.

CD ROM MARKETS ARE SOFTWARE DEPENDENT

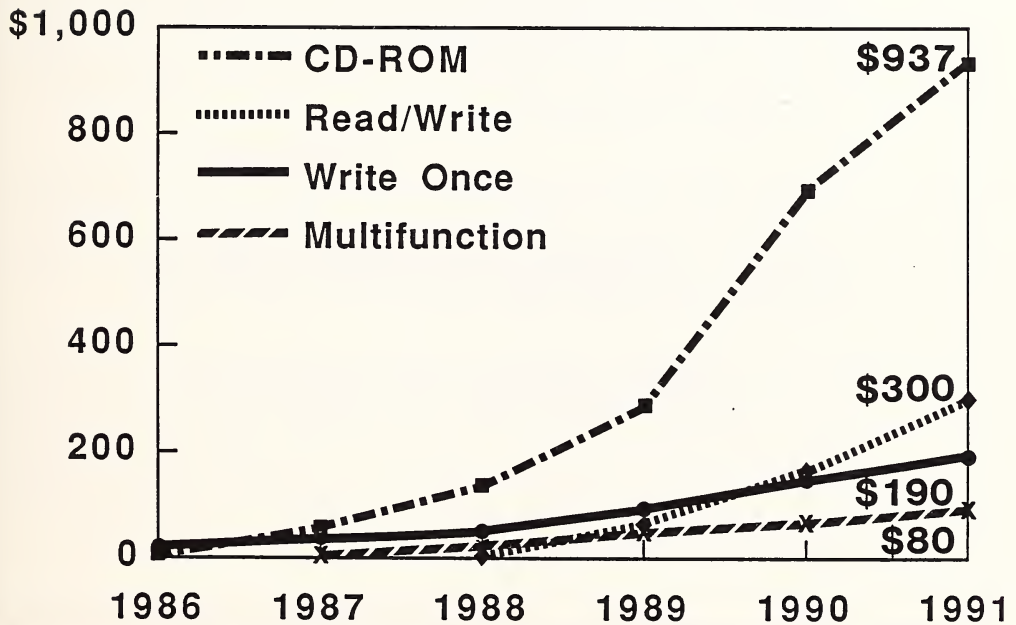
- **CD ROM Personalizes Data Base Use Like
the PC Personalized Information Processing**
 - **Main Added Value: Specific, User-profile/
Data Content-oriented Search Capabilities**
 - **Generic Search/Index Software Available**
 - **Specific Application Software Needed**
-

C. OPTICAL DISK MARKETS, 1986-1991

- CD ROM is not the only optical disk technology available to users, and the choices will be further enhanced through 1988. Already WORM (write once read many times) drives with storage capabilities of up to one gigabyte per surface are being sold at \$10,000 per drive. Over the next five years, CD ROM sales are expected to reach \$937 million a year, while read/write drives, which will appear in 1988, will be an easy second at \$300 million by 1991. WORM and multifunction drives will not be as successful (see Exhibit II-3).
- WORM drives have several immediate applications including backing-up large data base files and creating audit trail copies of files (showing how data evolves from one period to the next). Read/write capabilities are not expected in commercial quantities before 1988.
- Although combining the flexibility of a magnetic disk with the storage capacity of CD ROM, read/write disks will initially face some difficulties in penetrating the market. Unlike CD ROM (which has a narrow, specific, focused market) read/write disks are a direct replacement for manufacturers' juiciest peripheral--magnetic disks. Few are likely to want to rush into replacing established product lines with such a dangerous competitive product.
- Multifunction products already on the market combine two different technologies in tandem (either two optical or one optical and one magnetic). Most likely, read/write drives will be teamed with write-once disks to provide the best of both worlds with enhanced applicability to storage of combinations of volatile and semi-permanent data/information.

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OPTICAL DISK MARKETS, 1986-1991 (\$ Millions)



D. ADOPTION OF CD ROM HINDERED

- Despite being the first commercially available optical storage media--and the initial, favorable reaction it received from manufacturers, software houses and applications developers--CD ROM is not making very rapid progress for a number of reasons (see Exhibit II-4).
- First, no major vendor has endorsed the concept of using CD ROM to date. None of the top seven computer manufacturers (including IBM) has announced a product. Most of the vendors are small manufacturers who have limited capability to market their products. The sum total of those marketing efforts does not amount to very much.
- Secondly, users faced with anything new are reluctant to commit themselves to a change in habit or media. The economic analysis is greatly in favor of CD ROM and getting better every day. However, it takes more than a good price/performance ratio to move a user from one media to another.
- Part of the problem is that there is little to differentiate CD ROM applications from current magnetic media. This is because the software that could make that difference is not yet available. There is, therefore, a catch-22 situation developing--large manufacturers are hesitant to endorse a young product and software vendors are reluctant to invest. Therefore, without the software user, demand is not high.
- Finally, since there is a dearth of off-the-shelf packaged software available, most user applications require extensive hand-holding. This reduces the profit margin for the supplier and/or makes the price tag for the implementation higher than normal.

ADOPTION OF CD ROM HINDERED

- **Limited Marketing Strength of CD ROM Vendors, Absence of IBM**
 - **User Inertia**
 - **Limited Software Availability**
 - **Extensive Hand-holding Needed**
-

E. MINIMAL SELF-IMPACT

- One of the reasons that information services vendors and manufacturers are adopting a cautious attitude toward implementing/offering CD ROM is that there is a fear of self-impact:
 - For manufacturers it is the fear that magnetic storage peripheral sales will suffer (just at a time when peripherals are the most popular and profitable selling item).
 - For information services vendors it is the fear that on-line data base services will be adversely impacted by CD ROM-based turnkey systems, taking on-line service to a cheaper off-line solution.
- There is some merit to such considerations, but fear of substantial or wholesale customer defections is largely unfounded. There is ample precedent for this. When on-line services were implemented by publishers, there was a fear that printed products sales would fall off. But they did not and, in fact, in some instances on-line service use has encouraged sales of printed products.
- More fundamentally, however, the data bases needed to build attractive CD ROM products are largely in the hands (i.e., owned by) of the very publishers and on-line data base service vendors who fear the impact. They are, therefore, well placed to control the situation.
- Exhibit II-5 summarizes the main points.

MINIMAL SELF-IMPACT

- **CD ROM Impact Fear Largely Unfounded**
 - **Online Data Base Services Have Not Impacted Sales of Print Products (in Some Cases They Have Risen)**
 - **Usually, Control of the Data Is in the Hands of Publisher/Online Service Vendor**
-

F. IMPACT OF CD ROM ON INFORMATION SERVICES VENDORS

- Information services vendors are concerned about the impact of CD ROM on their markets and would also like to know if this new technology presents any opportunities for them. The answer is an emphatic "yes" (see Exhibit II-6).
- The opportunities relate to the vast spectrum of PC reference storage applications that target specific "working professional" workstations. These applications will be single or multipurpose uses of a set or subset of semi-permanent data.
- Examples include property tax assessment (with as many data bases as there are counties), student academic achievement records (data base per university or educational facility), real estate loan portfolios (data base per bank)--in short an infinity of applications where regular access to reference data is an integral and necessary part of doing business.
- These are areas of impact that should be expected to affect current business lines. Whether the effect will be entirely negative remains to be seen. Foremost among these are published/printed products and computer output microfilm (COM) services.
- In most other areas, the impact will be entirely positive--software vendors (both applications and systems) should benefit handsomely as should turnkey systems vendors. Hybrid services from RCS vendors will also encourage on-line data base use.

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IMPACT OF CD ROM ON INFORMATION SERVICES VENDORS

- **Opens Markets for PC Reference Storage Applications and 3rd Level SIC Workstations**
- **Impacts:**
 - **Hardcopy Publishing/COM**
 - **Software Developers (New Markets)**
 - **Turnkey System Vendors (New Markets)**
 - **RCS/OLDB Vendors (Hybrid Systems)**

G. CD ROM MARKET PENETRATION WILL BE SLOW

- Despite all of the positive, exciting, and new aspects of CD ROM, it is INPUT's considered opinion that market penetration is going to be at a slow pace, at least until 1988. We have discussed a number of reasons why this is so in this section. Exhibit II-7 summarizes these.
- A number of nagging problems still remain with CD ROM, principal among which is the lack of standard recording formats agreed to by the main vendors. This problem is being resolved but must be cleared before serious market development can begin.
- It would, nevertheless, be a great mistake to adopt a "wait and see" attitude toward optical storage. For one thing, optical storage is inevitable, based on price and performance. CD ROM is the front-runner of this new technology and must be used as a staging ground for each vendor's plans and trials. To avoid doing so is to simply accept losing a year or more to competitors and few vendors can afford this luxury.
- CD ROM is not just an optical storage "proving ground." It offers concrete opportunities of its own that ought to be seriously considered by all information services vendors. Multimedia opportunities, particularly voice-over commentary of data/text or text/image data bases, represent the most exciting potential in the near-term.

CD ROM MARKET PENETRATION WILL BE SLOW

- **User-profile/Data-specific Knowledge is Scarce**
 - **Information Providers/Users Cautious**
 - **Heavy Start-up Cost for Applications**
 - **Standards Still a Problem**
-

III CD ROM MARKET EVOLUTION

III CD ROM MARKET EVOLUTION

- The growth and development of the CD ROM market is tightly linked with a number of issues that are not all price and performance related. These include not only relations between hardware manufacturers, information providers, CD ROM service centers, distributors, and retail outlets, but also the early developments in compact disk standards.
- Over the next five years much of the end-users' attention will be focused on how fast the price for a CD ROM drive drops, how fast the number of usable CD ROM "titles" (i.e., prerecorded data disks) grows, and how fast CD ROM title updates can be created. There is no doubt that these factors, more than any others, will influence demand. However, the supplier side of the equation will be driven by distribution channel considerations, data ownership issues, standards, and compatibility.

A. CD ROM STANDARDS

- Since 1980, Philips and Sony have been leaders in attempting to avoid a repetition of the bitter battles fought between 1972 and 1976 over the choice of standards for optical videodisk systems. Laservision was the ultimate winner of those early battles, but not before close to half a billion dollars of vendor R&D was wasted. It can be argued that the delay in coming to an agreement discouraged the market, as well as the many vendors that fell by the wayside during that hectic period.

- Agreements on how to proceed with CD ROM, prior to investing, have therefore been sought with good results. First to emerge was the "Red Book," a specification describing recording standards for compact disk digital audio players which gained wide acceptance. This has enabled the rapid creation of CD audio disks since the standard was known and the disks could be played interchangeably on any of the commercial players/drives.
- Information storage and retrieval had broader requirements, specifically error detection and correction capabilities. Though CD ROM and compact disks share the same laser optics, medium, mastering process, and Servo electronics, CD ROM cannot tolerate the same error rates as CD; it must in essence be error free (in practice one byte in 10^{12} or 1,000 times better than CD). This equates to one byte in 2,000 CD ROM disks (or one byte every 20,000 filing cabinets of data).
- The "Yellow Book" standard was created to answer these needs and provides a physical recording standard for CD ROM, using 270,000 records of 2,336 bytes each, of which 288 bytes are used for error detection and correction coding (leaving 2,048 bytes of useful space per record).
- Out of this general CD ROM standard, two other standards have emerged:
 - The "Green Book" that defines standard ways to represent information destined for the consumer and entertainment market (also called CD-Interactive or CD-I).
 - The "High Sierra Group" standard aimed at defining standard ways of representing data/text/image for commercial applications; most commercial applications do not require multimedia capabilities (which in any case consume vast storage capacity for each animated article).

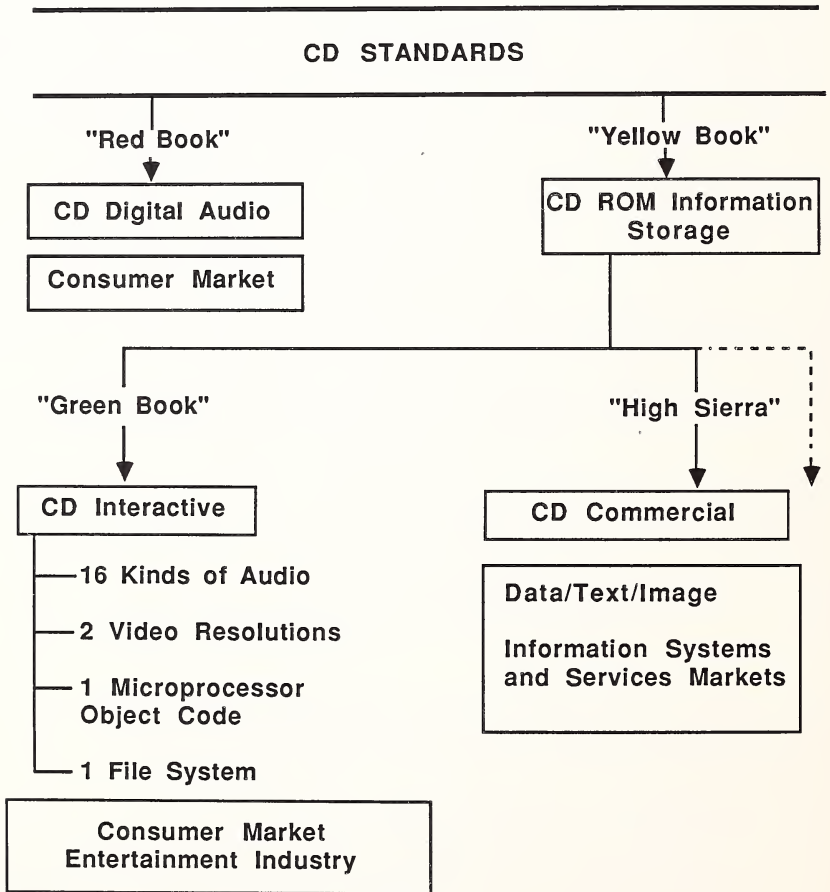
- Exhibit III-1 shows the relationship between the various CD standards known at present. It is likely that at least one more will emerge in the future. The problem that the "professional" PC user (i.e., who has his own PC for business and home use) faces is that it will be virtually impossible to "read" CD-I and CD ROM data disks on the same player. In addition, CD-I display specifications are more difficult than the PC display standards, so that a separate display will be required.
- CD-I is essentially a standalone player, and one that will not be commercially available until 1987. Its most likely target markets will be multimedia entertainment applications until the commercial market marshalls the skills needed to create meaningful multimedia applications relevant to U.S. industry.
- CD ROM's attraction is that it is very broad in its applicability to consumer, commercial, educational, and entertainment markets. Therefore, it will be of growing importance to the information services market as its use expands.
 - Applications which use CD ROM to support existing, voluminous reference/historical files (the so-called "transfer applications").
 - Applications that profit from CD ROM's availability to automate the access to paper files or computer output microfilm files.
 - Text/image applications that serve vertical industries.

B. INFORMATION SERVICES APPLICATION MARKETS, 1986

- All CD ROM information services markets rely on the need for a body of users to access large volumes of text, data, and images, the frequency of updates of which is relatively slow. The body of data may be "owned"/controlled by the

EXHIBIT III-1

COMPACT DISK STANDARDS - AN EMERGING FAMILY



information services vendor or it may be obtained under license/agreement with a third party. Exceptionally, it may be published data in the public domain (e.g., government statistics, census data, etc.).

- Generally speaking the best market opportunities are for "unique" sets of data, either because the format under which the data is provided is particularly attractive to end users or because it is only available through the vendor. Ease of access (i.e., the type of software commands needed to access, manipulate, and search the file) also plays a fundamental role.
- There is no doubt that the most significant opportunity in 1986 and in the next two to three years will be in the PC market. This is for a variety of reasons:
 - CD ROM has no impact on the magnetic storage markets related to the PC; the same cannot be said for large mainframe magnetic storage devices such as tape drives, disks, etc., or for computer output microfilm (COM) storage devices.
 - CD ROM has significant attractions to PC users who habitually access large reference files, either manually or on-line via a network. CD ROM drive prices must come down to develop this underlying demand.
 - PC markets are matrixed by a strong dealer/distributor network for product sales and support. This same dealer/distributor network is the ideal tool for rapid CD ROM penetration of the installed PC base.
- It is also likely that CD ROM products will be primarily addressed to the business/commercial market rather than (as with the PC) the consumer market first and then the business user. This is because the growing maturity of the business PC user makes for a combination of a personal processing tool (PC) and personal archival/storage (CD ROM) very attractive. How fast CD ROM will be accepted is conditioned by the variety, relevance, and availability of titles (CD ROM disks with specific types of prerecorded data).

- To date, the CD ROM applications that have been targeted have been predominantly "transfer" applications--the deployment of existing data/text files on a CD ROM disk. The software fronting these transfer applications has been basic in function and generic in capability (i.e., with very little customization for the data processed or for the user community that uses it).
- This will change gradually:
 - The titles released will become more specific in nature.
 - The combination of data and text, text and image, etc. will require higher-function capabilities.
 - Competition will drive vendors to seek ways of differentiating themselves through product specialization.
- Given the flexibility provided by applications software, it is theoretically possible to provide a single CD ROM disk (title) that provides information to more than one application market. Since the manner of using the data/text and the display formats (and the access formats and options) are all part of the applications software resident in the central processor, this differentiation of markets within a common CD ROM disk is easily achieved.
- Exhibit III-2 shows the projected growth of the top ten CD ROM information services applications markets. First and foremost, of course, is the publishing/news market. It is unlikely that CD ROM will have significant impact on current printed products; the printed word is too familiar and cheap. Rather, CD ROM will provide additional delivery methods for existing products and some new ones. Already we have seen dictionaries, encyclopedias, and (shortly) aerospace maintenance manuals appearing on CD ROM.

EXHIBIT III-2

CD ROM INFORMATION SERVICES APPLICATIONS MARKETS
(\$ Millions)

MAJOR APPLICATION	1986	1987	1988	1989	1990	1991	AAGR
Publishing/News	3	8	21	67	230	520	180%
Libraries	1	2	4	10	65	145	171%
Legal	0	0	1	4	19	90	N/A
Medical	0	1	4	14	40	130	N/A
Securities/Financial	1	4	12	40	95	280	209%
Credit	0	1	5	13	35	125	N/A
Demographic/Resouces	0	0	1	3	15	65	N/A
Real Estate	0	0	2	10	38	120	N/A
Econometric	0	0	1	8	26	70	N/A
Education	0	1	3	9	30	120	N/A
Other	0	0	2	9	34	435	N/A
Total	\$5	\$17	\$56	\$187	\$627	\$2100	235%

- The securities/financial market is another natural CS ROM market--not only does the professional need to access up-to-the-minute quotes on public companies, but he needs to know trend data based on historical analysis. Furthermore, press releases on products, quarterly results, etc., must be available on demand. A large part of the inquiries on historical/reference material would be ideally handled off-line by CD ROM-supported PCs.
- Presently, the range of CD ROM applications is vast but relatively untouched. INPUT believes that in the short space of five years, CD ROM applications will add over \$2 billion in new revenues to the information services market. Most of these revenues will be absorbed by turnkey systems (\$800 million in 1991) and software products (\$610 million) vendors.
- An alternate look at the information services CD ROM applications market is provided in Exhibit III-3. This separates the applications market into three categories of services and products:
 - CD ROM upgrades: those applications that are essentially direct transfers of existing files (data or text or images--no coordination of all three) onto a CD ROM disk for access by simple utility software packages.
 - New services: those applications that are designed from scratch to target specific vertical markets and take into account unique CD ROM characteristics (e.g., indexing and simple combinations of text and/or data or text and/or images).
 - Multimedia products/services: those applications that are true multimedia products and services (e.g., commented illustrations, verbal menu explanations, animated articles). These applications will require multidisciplinary teams of skills drawn from the communications industry, book publishing, sound recording, film/TV/video production and the information services industry.

EXHIBIT III-3

**CD ROM MARKETS BY MAJOR APPLICATION
(\$ Millions)**

APPLICATION TYPE OF SERVICE	1986 CD ROM MARKETS			1991 CD ROM MARKETS		
	Up-grades	New Services	Multi-media	Up-grades	New Services	Multi-media
Publishing/News	\$3	*	*	\$260	\$180	\$80
Libraries	*	\$1	*	50	75	20
Legal	*	*	*	*	90	*
Medical	*	*	*	60	70	*
Securities/Financial	*	1	*	60	130	90
Credit	*	*	*	*	105	20
Demographic/Resources	*	*	*	5	50	10
Real Estate	*	*	*	10	70	40
Econometric	*	*	*	50	20	*
Education	*	*	*	15	45	60
Other	*	*	*	210	150	95
Total	\$3	\$2	*	\$720	\$965	\$415

- In 1986 many small market services began as vendors initiated the long process of product/service analysis, title selection, file conversion, and distribution channel set-up. Some interesting products have already surfaced. Perhaps most successful from a commercial standpoint is Grolier Electronic Publishing that has released a CD ROM-based version of its 20 volume Academic American Encyclopedia. Twenty-five dealers have signed up to retail it (along with the CD ROM drive necessary to read the disk). It is offered with Philips, Sony, and Hitachi drives, KnowledgeSet's Retrieval System, and a 142,000 key word index. It is compatible with IBM PC, XT, and AT.
- By 1991, INPUT sees an explosion of new products and services. Predominantly new services (nearly \$1 billion) are expected to be targeted.

C. PRODUCT AND SERVICE POSITIONING

- In order to facilitate the adoption of CD ROM-based services and products, it is necessary to either:
 - Make use of existing user interfaces.
 - Utilize simple menu/key word, choice-based interfaces.
 - Employ specific terms and logic that are compatible to the vertical market user group that is targeted.
- The best example of the first approach, that of using existing user interfaces, is TMS Inc.'s Laser DOS^{T.M.} system, which also conforms to the "High Sierra Group" standard of CD ROM file organization. The product takes the mystery out of user CD ROM by using MS-DOS commands to execute obvious steps:

- To list the directory of files on the CD ROM-type "DIR" (as with MS-DOS).
 - To copy a file from CD ROM to floppy-type copy, etc.
- The applications developer need not be concerned with the different addressing systems that exist between Hitachi and Sony drives (or the physical organization differences between CD ROM and Laser Vision Videodisk)--Laser DOS does it for him. In the same way the end user finds himself immediately able to accomplish useful work with the new system through the use of familiar commands.
 - A good example of the second approach (using simple menu/keyword, choice-based interfaces) is Knowledge Set's Retrieval System (which was customized to adapt it to the content and structure of the Grolier Encyclopedia). Virtually no documentation is necessary for the system to be readily put to use by the neophyte user. Exhibit III-4 illustrates the search definition and the retrieval text.
 - The best example of the third category, a system that has been custom designed for a narrow specific purpose, is the Brown University "Isocrates" product. This allows a classics scholar access to all of the text of all classical Greek poets, dramatists, historians, philosophers, etc., prior to AD 700. Using a menu driven search, keyword lookups can be accomplished and a desirable text located. The CD ROM workstation operates a document preparation system concurrent to the search and display menu, so that a scholar's own document can receive "cut and paste" copies of the Greek text. In this way the document preparation is integrated with the thesaurus search and display.
 - Clearly, certain "building block" tools are necessary to progress toward CD ROM services and products. Key among these are system software packages that read/search CD ROM files in their various formats and offer menu driven

EXHIBIT III-4

SEARCHING FOR INFORMATION WITH THE ELECTRONIC ENCYCLOPEDIA

Knowledge Retrieval System Copyright ©1986 Activenture Corp. Monterey, CA			
F1 About Keys	F2 Search Words	Search Option Article Titles Bibliographies Fact Boxes Tables Article Text All Categories	WORD SEARCH TO FIND A TOPIC Enter search words at blinking cursor, then push SEARCH WORDS to find article titles. Then push SHOW TITLES to select an article.
F3 Lookup Words	F4 Show Titles	Relation Option Negate Words In an Article In a Paragraph Words Apart 20 Exact Order	
F5 Search Option	F6 Relatn Option		
F7 New Query	F8 Save Query	Enter One or More Search Words <input style="width: 150px;" type="text"/>	
F9	F10 Select Search	The Word(s) SPACE SHUTTLE _____ along with _____ along with _____ along with _____ along with _____	
		ESC	
KAS TITLE SELECT SEARCH WORD SEARCH I			

The Electronic Encyclopedia Copyright c 1986 Grolier, Inc. Danbury CT			
F1 ABOUT KEYS	F2 OUT- LINE	<div style="border: 1px solid black; padding: 5px; display: inline-block;">Space Shuttle</div>	
F3 PREV PAGE	F4 NEXT PAGE	<p>First flown in 1981, the Space Shuttle has been planned to become the principal U.S. space launcher and carrier vehicle, replacing the expendable launchers used since the late 1950's. The Shuttle is the most visible component of the Space Transportation System (STS) being developed by the National Aeronautics and Space Administration. Other components are: upper stages, Spacelab, launch facilities, mission control centers, the tracking and data-relay satellite system and supporting centers.</p>	
F5 PREV PARAG	F6 NEXT PARAG	<p>COMPONENTS. The three main components of the space shuttle are the orbiter, the external tank, and the solid rocket boosters. The Shuttle weighs 2.0 million kg (4.5 million lbs.) at launch and stands 56.1 m (184.2 ft) tall. It can carry up to 29,500 kg (65,000 lbs.) of cargo on one mission.</p>	
F7 MAKE COPY	F8 NEXT ART		
F9	F10 Word Search		
Push F1-F10			
KAS TITLE SELECT SEARCH WORD SEARCH SHOW TITLES S-OW TEXT			

options or that allow the use of familiar commands (e.g., DOS/MS-DOS). Customizing these tools and integrating them into other standard software tools (e.g., word processing packages, file handling packages, etc.) offers a means of handling the data, text, image, etc. once it has been retrieved.

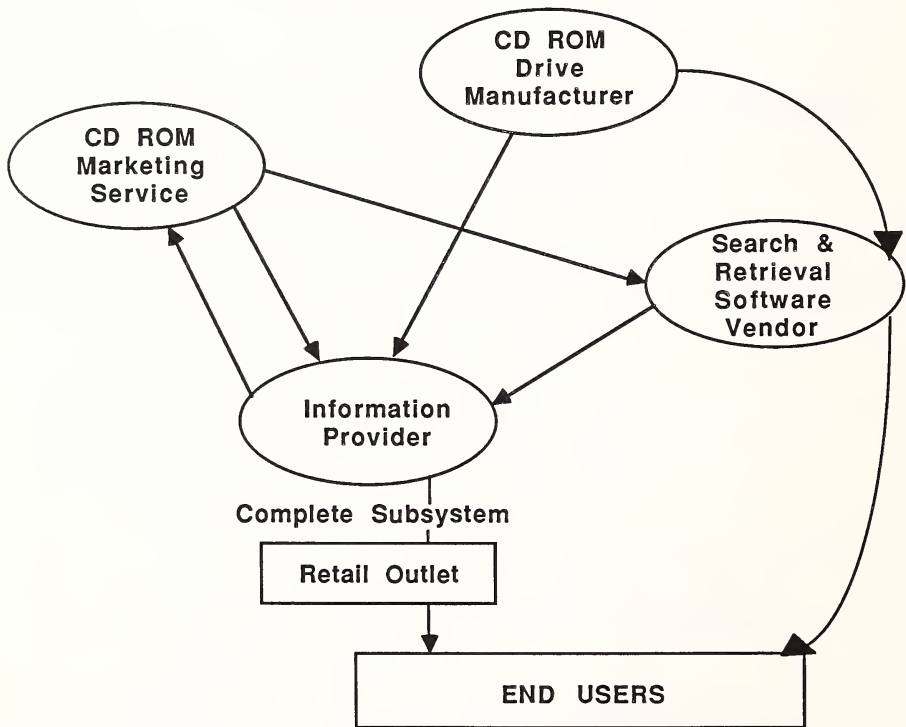
- The key to a successful adaptation of CD ROM is, therefore:
 - Identification of a stable body of information.
 - Identification of a body of users for this information.
 - Identification of the knowledge level and thought processes of users in searching for/manipulating this information.
 - Creation of a tool that satisfies all of the above.

D. CD ROM DISTRIBUTION CHANNELS, 1986-1991

- The CD ROM market is in a confused state so far. In the rush to bring the (limited) CD ROM products and services to market, hardware vendors, information providers, software vendors, turnkey system vendors, and distributors have assumed sometimes illogical and sometimes conflicting roles (see Exhibit III-5).
 - System software vendors have been directly selling CD ROM subsystems to end users (i.e., CD ROM drive, disk, and access software).
 - Information providers have been selling subsystems directly and through retail outlets.

EXHIBIT III-5

CD ROM DISTRIBUTION CHANNELS, 1986



- Hardware manufacturers have been acting as a publisher on behalf of information providers.
- The only groups to have stuck to their traditional roles have been the CD ROM drive manufacturers and retail outlets.
- An example of a system software vendor selling CD ROM subsystems to end users is KnowledgeSet (who also sells its software to Grolier Electronic Publishing which packages the software), Philips CD ROM drive, and Grolier's data disk, and sells the subsystem through a small group of 25 retail dealers--all of them PC dealers.
- An example of a hardware vendor acting as a publisher for information providers is DEC who, until recently, marketed 12 CD ROM titles from national Technical Information Service, Engineering Information Inc., Chemical Abstracts Service, Fraser Williams, and others. DEC finally decided that the conflict of interest between it and other publishers was best resolved by abandoning the publisher role and sticking to data preparation, mastering services, applications development, and CD ROM drive sales. Only the last activity is really relevant to DEC's role as a hardware manufacturer and sales organization. (It is not clear why DEC would want to compete with data preparation, mastering services, and applications development groups that are the CD ROM world's equivalent to third-party and information services groups that have made DEC a success).
- The key to CD ROM market development is establishing a network of dealers and resellers (and possibly library and software publishers) to carry the CD ROM titles in the same way as software titles are currently carried by over 6,000 retail outlets. This can occur when a minimum of approximately 200-300 titles exist that have fairly broad interest.
- CD ROM drive prices are no longer prohibitive; for around \$1,500 a PC user can have a CD ROM drive, search/access software, and 500 MB of pre-

recorded data base. The main difficulty is finding data to fill those 500 MB, preferably data that is vital or at least relevant to the PC users' daily requirements. Many such data bases exist but their owners (on-line data base service vendors) will be hanging onto them like grim death until forced by competitive products to produce a CD ROM disk.

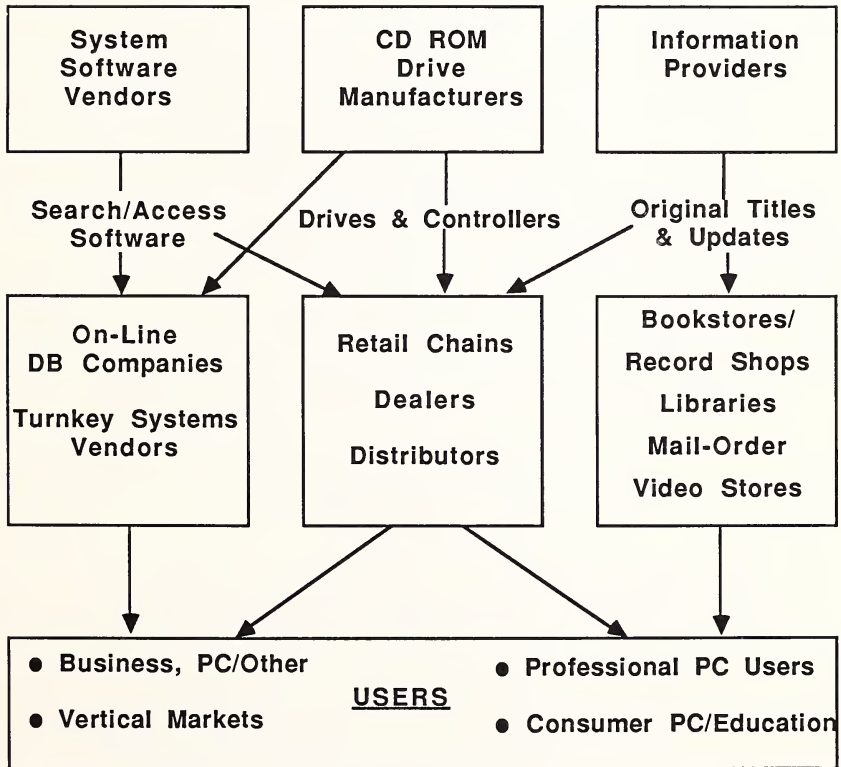
- What can be done about it? Well, to begin with, a small wave of new and updated titles is already arriving on the market. Most are not widely marketed or distributed, but that will change during the 1986-1988 period. INPUT pinpoints 1987 as the year when the rush for signing up dealers and distributors for CD ROM titles will occur. This will make publishing a new title a lucrative business; just filling a basic shelf inventory order to display a single new title should be worth \$1 million to the publisher.
- In the meantime, there are many other lucrative, semicaptive markets to target. Principal among these are the information publishers who have standard, period deliverables such as:
 - Securities and commodities.
 - Quotron.
 - Monchik-Weber.
 - ADP.
 - Allied Information Systems.
 - News.
 - Mead Data General.
 - Telerate.

- . Dow Jones.
- . Reuters.
- . National Newspapers.
- Credit.
 - . TRW.
 - . Trans Union.
 - . Equifax.
 - . Telecredit.
 - . Tymshare.
 - . National Data Corporation.
 - . Chilton.
 - . Computer Sciences Corporation.
 - . Dun & Bradstreet.
- Bibliographic.
 - . Online Computer Library Center Inc.
 - . Lockheed/Dialog.

- . Systems Development Corporation.
- . BRS.
- Each of the above has the opportunity to offer to its regular customer base an electronic search/access version of its current printed products. Eventually, INPUT believes they will be forced to do so by competitive pressures whether they want to or not. At least one company in each of the preceding four categories listed has already developed a CD ROM prototype file. The release of these products onto the market is going to force the remaining companies to swiftly evaluate their own plans.
- By 1991 the distribution channel structure for CD ROM in the U.S. will be stabilized along functional responsibility lines (see Exhibit III-6).
 - System software vendors will rely on companies developing applications (on-line data base companies and turnkey system vendors) to access their business customers and vertical market needs. Retail chains, distributors, and dealers will supply consumer and professional PC users with horizontal market systems. Note that the on-line data base vendor acts as the information provider for its own data bases.
 - Information providers will concentrate on generating new titles and continuing regular updates. Their access to the marketplace will be through the same retail chains as above but also through bookstores, record shops, libraries, mail-order firms, and video stores, particularly for consumer PC users and for the education and entertainment market.
 - CD ROM drives will reach the user through retail chains, distributors, and dealers, or packaged with proprietary products via the on-line data base vendors and the turnkey system vendors.

EXHIBIT III-6

CD ROM DISTRIBUTION CHANNELS, 1991

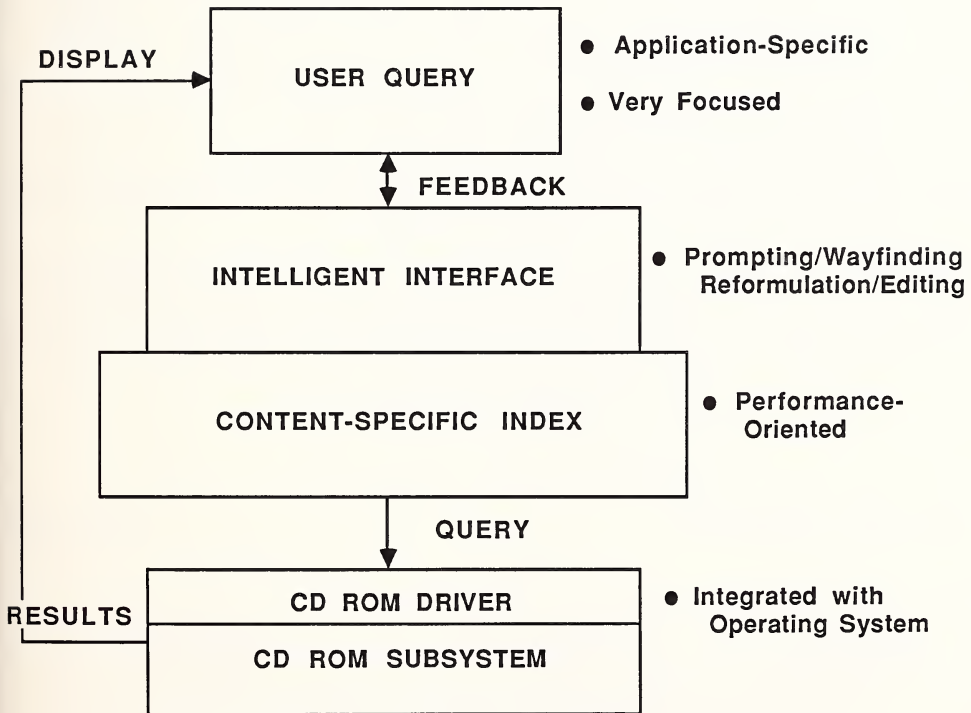


E. APPLICATION DEVELOPERS

- While information providers (i.e., those who own data bases that have relevance to CD ROM applications) are clearly in the driver's seat when it comes to allowing access to their information, few of them will have the skills necessary to adequately translate the market potential that the information has into useable CD ROM products and services.
- In the first phase of the CD ROM market (that of transferring existing files from their current medium to CD ROM) a minimum of applications development is necessary. In most cases, direct copy of the information from its paper file, magnetic tape, or magnetic disk is all that is required. At this stage, the "applications software" consists of either standard functions from a file handling system software package (e.g., STA/F file from Reference Technology) or minor customization of the same.
- In the second stage of the CD ROM market's development, the accent will be on product differentiation and specificity. In that phase three elements, mainly software-driven, will be required of the application (see Exhibit III-7).
 - Customized user interface: allowing for the idiosyncrasies of the user in terms of search requirements, terminology employed to direct the search, and menu options proposed.
 - Customized search process: taking into account the content and indexing of the data base and optimizing the performance.
 - The ability to make use of generalized disk formats for specific applications. It may be that a single data disk will be used for more than one set of applications (e.g., a CENSUS disk being used for real estate developers and television advertisers).

EXHIBIT III-7

CD ROM SOFTWARE MARKETS



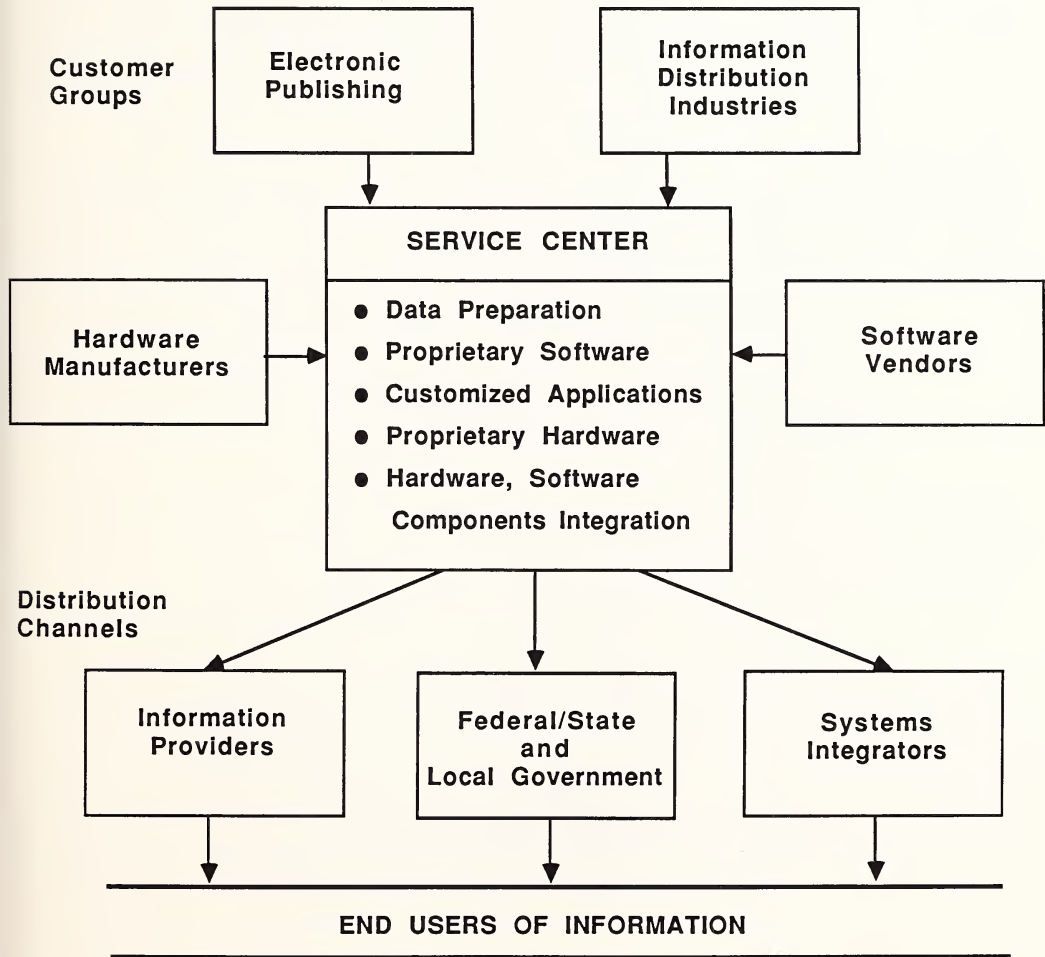
- In a real sense there are few application developers in the market today (companies that are able to sense the possible applications for a given set of information, whether data-, text-, or image-oriented, and construct applications to exploit the opportunities). Those that do offer applications services are usually not in the driver's seat in terms of determining the thrust of the application but are used to construct code to someone else's specification.
- In many ways this is only natural since those vendors that have the application knowledge (understanding of the market need, knowledge of user requirements, etc.) do not have the CD ROM technical skills necessary to produce the application code, while those that are technically-oriented generally have limited understanding of the user requirements. Without a combination of these skills being brought together, however, little progress will be made in the production of useable titles for the CD ROM market and, consequently, the need for CD ROM drives will be diminished.
- Thus, an important role in the development of the CD ROM market devolves to the service center or those organizations who have set themselves up to integrate the components, a service required to create data disks and the tools to access them.

F. SERVICE CENTERS

- In the absence of a broad variety of application developers, there has developed a group of service centers whose capabilities range from straight data preparation to sophisticated hardware and software component integration and customized applications development (see Exhibit III-8).
- Most data centers handle both 12-inch optical read only data plates of two gigabytes (one gigabyte per surface) and 12 centimeter CD ROM disks storing 550 MB. Some supply jukebox arrangements (robot arm selection of stacked

EXHIBIT III-8

SERVICE CENTERS' ROLE



12-inch disks with a reader, providing up to 40 gigabytes of on-line storage with an average 13 second access time), some offer direct connection of up to eight CD ROM drives (providing up to four gigabytes of information on-line with an average 900 millisecond access time).

- The service centers direct most of their attention to electronic publishing or information distribution industries, the two largest potential sources of their business. This includes the federal government agencies which are a market in themselves. The role of the service center is that of "CD ROM problem solver"--taking a customer's wish and turning it into a CD ROM product.
- Most service centers deal with a variety of hardware manufacturers to obtain the CD ROM drives (most frequently, Hitachi, Sony, and Philips). They also do some hardware development of their own, producing controllers, switches, and interfaces that will tie workstations, multiple CD ROM (or other optical) drives, and processors (PC and other) together. This usually involves proprietary software (e.g., a file handler), often external software products from other software vendors, and frequently customized applications software developed for the specific customer's requirements.
- The key to the service center's success is the degree to which they can develop and maintain all of these links:
 - Establishing a relationship with, say, an information distributor (e.g., McGraw-Hill) and becoming the supplier of CD ROM services for all of its CD ROM products requires constant sales and marketing effort plus ongoing support at a variety of levels within McGraw-Hill.
 - Hardware manufacturers have very little loyalty, but the service center must maintain close technical contact with all of them to ensure that any product/technology changes are instantly reflected in the service centers' own products and services.

- Software vendors have greater loyalty but also usually deal with end users directly. Service centers must ensure currency with and competence in any new releases of products they use.
- The distribution channels are vital to product and service market growth. In some cases, principally information providers and government, the customer is the market and distribution channel roled into one. The most underdeveloped of all is the group of systems integrators for whom CD ROM is only a part of their total system and who control access to many vertical markets.
- Without the central role played by the service centers, the CD ROM market would be at a standstill. At present, there are very few professional centers because the need for CD ROM has yet to fully emerge. As the market takes off, however, the need for service centers will expand rapidly offering opportunities for many information services companies.

G. PRICING AND PACKAGING

- With few CD ROM products and services on the market as yet, there is little standardization (or experience) in how to handle CD ROM pricing. There are many options (see Exhibit III-9), but at this stage in the market's development, the two highlighted options are the most attractive.
- Both concern bundled pricing and leasing programs. The significance of the leasing aspect is that because CD ROM products, from drives to recording standards, are subject in the next two years to so much volatility and change (either because the technology changes or the format changes or the software changes), users would be justified in holding back from committing themselves to CD ROM.

CD ROM PRICING OPTIONS

- **Bundled with Data/Information**
 - Value-in-Use Pricing
 - Unique to Data/Information Format
 - Leased with Data/Information
 - Updates Released with Data/Information
- **Bundled with Storage Unit/Interface**
 - One-Time Package Price
 - Lifetime Lease
 - Support Separate
- **Bundled with System**
 - Rent/Lease/Buy
 - Support Bundled with System Maintenance
- **Unbundled**

- To avoid this volatility of the technology (and to ensure that they benefit from the most recent advances), the vendor must take on the responsibility of ownership and lease the bundled system to the end user. In this way the subject of obsolescence need not arise and does not become an issue between the vendor and the end user.
- Where feasible, the leasing option should apply to the largest set of computing elements possible.
 - An effort should be made to avoid having to unbundle the lease of information from the lease of access/search software.
 - If possible, the lease of the software/information bundle should be included within a lease of storage unit and interface.
 - If possible, the lease of the above should be an indistinguishable element of a lease of the system driving the CD ROM subsystem and using the information/software package.

IV PROCESSING SERVICES VENDORS AND CD ROM

IV PROCESSING SERVICES VENDORS AND CD ROM

A. MARKET OUTLOOK

- CD ROM is best suited to off-line, historical, or reference search of large data bases which can be equivalent in size to any of the on-line data bases offered by remote computing services vendors. However, the CD ROM off-line service has two distinct drawbacks:
 - The information that can be accessed is not up-to-the-minute (or the month for that matter).
 - It cannot be updated, so that the access has no significance to a subsequent user.
- In a real sense these disadvantages are small and diminishing. The currency of the information is a matter of money (and scheduling)--if a regular data conversion schedule can be established with a data center (and providing that cost is not a major factor) turnaround times can be as little as one week. Moreover, albeit in limited fashion, data can be updated on WORM disks (by reading a block of data, updating it in memory, and rewriting it to disk).
- Access times are usually in favor of CD ROM. An average of less than one second is not uncommon, whereas an on-line data base access from an RCS vendor can average three times that delay. Access costs are easily in favor of CD ROM, where access is not "metered."

- As a group, the processing services vendors have the most to lose and the least to gain from CD ROM (see Exhibit IV-1). Their on-line data base services are one of the main targets for CD ROM products (and computer output microfilm, another processing service, is also a good CD ROM market target). For the most part there has been little attempt on the part of processing services vendors to examine the opportunities open to them in CD ROM. There are major exceptions to this which are examined below, but it is significant that those that have the most to lose are precisely the companies that prefer to wear the blinkers at this point. The comparison of on-line data base services characteristics versus CD ROM services is shown in Exhibit IV-2.

B. AUTOMATIC DATA PROCESSING CORPORATION

- ADP is the first processing services company to reach \$1 billion in revenue (and the largest information services company in the world). ADP's business base is essentially divided into six key areas:
 - Commercial services that supply payroll and accounting services, predominantly batch processing, to customers of all sizes and industries. It is ADP's oldest and largest service base and has consistently produced over 50% of the revenue base. These services have little use for CD ROM.
 - Network services that provide RCS and on-site distributed processing services and value-added network services, again with little use for CD ROM.
 - Collision estimating services that offer U.S. and Canadian customers on-line services estimating automobile repair cost. The service

EXHIBIT IV-1

CD ROM IMPACT ON PROCESSING SERVICES

- **Positive:**
 - **New Hybrid Services (\$525M: 1991)**
 - **WORM Back-up Services**
- **Negative:**
 - **On-line Data Base Services (\$60M: 1991)**
 - **COM Services (\$40M: 1991)**
- **No Impact on Facilities Management**

EXHIBIT IV-2

CD ROM VERSUS ON-LINE DATA BASE

ITEM	OLDB	CD ROM
User Interface	Generic	Specific
User Type	Many	Single
Cost	Unpredictable	Fixed
Access	Short/Specific	Relaxed/T&E
Data Update	Daily	Quarterly

produced \$60 million of revenue in 1985 and is an ideal CD ROM application. It is based on a parts data base for over 2,000 different domestic and foreign cars representing 90% of all 1970 and later cars in the U.S. Most of this data has a very slow update cycle which would accommodate a quarterly revision. A CD ROM-based turnkey system to existing clients, allied with an annual subscription to quarterly updates of the CD ROM disk would find a ready market.

- Brokerage services provide front office/back office data base services to securities, commodities, and futures contracts brokers, traders, and financial institutions. These services account for 11% of ADP's annual revenue. While much of the service is (and will remain) on-line and real time in nature, it could easily be complemented by CD ROM and off-line services offering historical/reference searches in the same functional areas. To a certain extent, this has already been achieved by a competitor--Dow Jones News/Retrieval (see later).
- Dealer services provide batch, on-line, and on-site accounting and management information services to 6,000 new car dealers and truck distributors. The services are too diverse and rely too much on volatile data to be a CD ROM target.
- Banking services have no CD ROM application.

ADP, to a large extent, has decentralized decision making among its operating groups. As a result, there is a decreasing level of coordination in technical evaluation and decisions. To date, CD ROM has not been featured in the plans of the world's largest information services company, leaving the door open to opportunistic competitors.

C. CONTROL DATA CORPORATION

- CDC has been involved in optical storage from the very early stages and is a joint owner, with Philips, of Optical Storage International (recently renamed Laser/Magnetic Storage International). To date, CDC has concentrated its optical storage activities in the larger write-once products in keeping with the very large files that CDC's typical customers use:
 - Oil companies (mostly exploration data).
 - Insurance companies (customer files).
 - Federal government departments (e.g., patent office).
 - State government (birth and death certificates).
 - Universities (grade history).
- CDC's information services activities are dispersed among several operating units within the company and represented nearly a quarter of the company's total revenues in 1985. Within those services activities, a number of CD ROM targets exist.
- Principal among these are the PLATO-based training services that are offered to primary and secondary schools. Because so many personal computers populate the schools already, it would be highly attractive to acquire PLUTO CD ROM disks to bring training services off-line. Commercially, it also might make PLUTO economically viable for CDC.
- CDC's PATHLAB III laboratory system provides patent test reports, management reports, and long-term record storage and retrieval. Write once optical storage is ideal for the latter part of the application and would sharply reduce

the costs of these turnkey systems (currently in the \$350,000 to \$1 million range).

- CDC has a variety of data bases that contain relatively non-volatile data. These include American Profile, Insurance Industry Data, X/Disclosure, X/FINDRS, X/MARKET, and X/REGION. All of these would easily be packaged for CD ROM use and would find ready acceptance.
- CDC is one of the most likely candidates for CD ROM application because of its structure, the markets in which it is active, and the natural fit between many of its services and CD ROM.

D. DUN & BRADSTREET

- D&B continues to grow at a 15% per annum pace despite its near \$3 billion size. CD ROM has enormous scope for application including:
 - Publishing: nearly all of the "Donnelley" Directories (yellow pages, independent telephone directories, airline guides, etc.) could be quickly and advantageously offered on CD ROM. Such a move would not supplant the published product but would only enhance revenues. They would offer national subscription services to a variety of businesses, reduce distribution costs, enhance usefulness, and increase the competitive edge of D&B.
 - Business information services: CD ROM application is more difficult here, but applies to the petroleum industry information/commercial credit reports and financial information reference services.
- For D&B, CD ROM represents information management, distribution cost control, improved competitiveness, and new business opportunities. For

example, D&B's successful Business Education Services are marketed almost exclusively through seminars which carry significant overhead in terms of training manpower, facilities, travel, and human resource development. Self-teaching variants of these courses could easily be made available on CD ROM disks and aimed at the business professional, the millions of very small businesses in the U.S., and the entrepreneurs.

E. DOW JONES NEWS/RETRIEVAL

- Dow Jones has been the first processing services vendor to realize the potential that CD ROM offers in its market, and to respond with an attractive product (and a very intelligent concept too). Dow Jones has combined with Datext to offer a system that will combine off-line CD ROM historical data search with on-line financial quotes from Dow Jones' News/Retrieval service.
- The system will be released toward the end of 1986 and uses an IBM PC, modem, and CD ROM disks and drive to search seven years of historical, public data on publicly traded companies. The nice feature of the system is that it allows the user to search the Dow Jones on-line data base with the same commands used by the off-line CD ROM data base (the Datext software automatically logs the end user onto the Dow Jones service and retrieves the most recent data on the company requested).
- The service, called CD/Newsline, covers approximately 10,000 public companies in 100 industries and provides financial statements, annual reports, investment analyst reports, business literature, and trade press extracts. In addition, biographies of directors, historical and current stock prices, and current business and financial news are included.
- To round off this existing service, Dow Jones and Datext have provided for the formatting and manipulation of the data once it has been retrieved.

Interfaces are provided for using the data with Lotus 1-2-3, Ashton-Tate's Multimate, and Micropro's Wordstar.

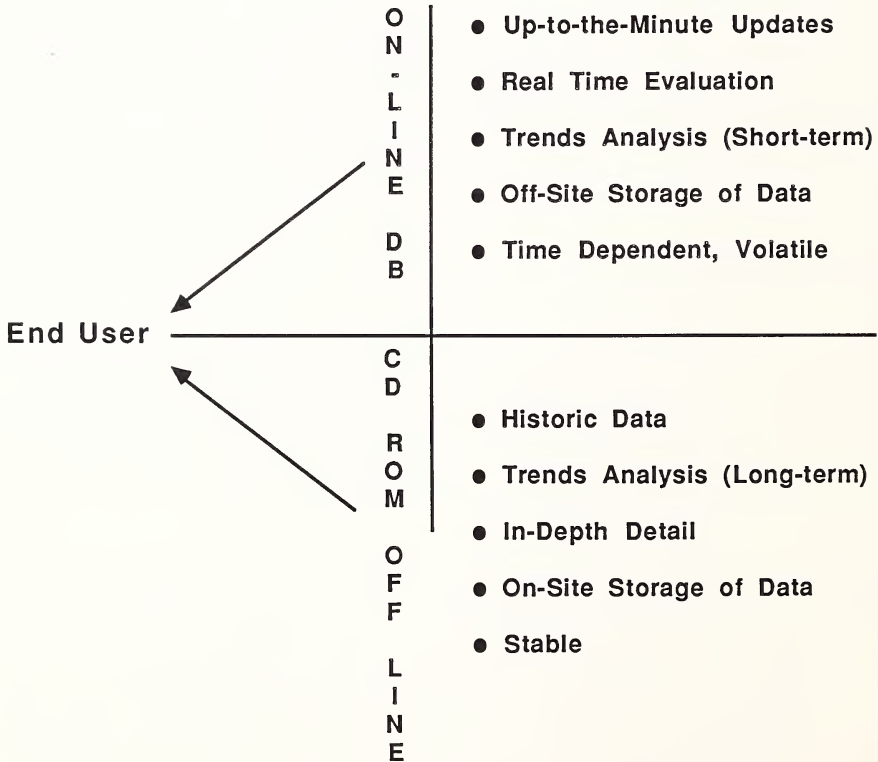
- The one major weakness of the service is the packaging. The service is offered as a subscription costing from \$14,100 to \$24,100, covering four sectors--consumer, industrial, technological, or service. This includes a specified amount of (free) access to Dow Jones' News/Retrieval Service. The weakness lies in the fact that whereas the service is a lease (subscription), the CD ROM drive necessary to use it is not leased.
- Dow Jones' approach is a forerunner of things to come in other electronic publishing and on-line data base markets where the emphasis will be for a clear division of responsibilities between the on-line data base and the off-line CD ROM services (see Exhibit IV-3) with little or no negative impact and tremendous upside potential for the on-line service.

F. MCGRAW-HILL

- McGraw-Hill is another, very high potential CD ROM user. This has been the company's own conviction for over a year and in conjunction with Reference Technology, 11 prototype data bases have been created for testing. By the fourth quarter of 1986 some of these should be ready for market introduction, but pricing and terms and conditions are not yet available.
- There are many areas beyond the planned data bases where CD ROM would be an excellent distribution medium. For example, McGraw-Hill Book Company obtains 43% of its revenue from higher education and 27% from elementary and secondary education. A majority of these products could make use of CD ROM capabilities, in particular the Compu Cat Quizware "Our Nation, Our World" type programs now produced for Apple users. The catalogs produced in this operating company could also be brought on-line via CD ROM.

EXHIBIT IV-3

CD ROM AND ON-LINE DATA BASES:
A DIVISION OF RESPONSIBILITIES



- Within the McGraw-Hill Information Systems Company, the Datapro reports, Sweets Catalog File, and Design Estimator Package could be more widely distributed and used through the application of CD ROM. The same is true (but this time in conjunction with the existing on-line service) for the recent Municipal Registered Bond Interest Record service.
- The list is extensive of CD ROM potential products: S&P Computstat service, Marketscope, S&P Debt Rating services, etc. All credit must be given to McGraw-Hill for moving aggressively into the CD ROM prototype stage ahead of its rivals.

G. CD ROM POTENTIAL IN PROCESSING SERVICES

- Exhibit IV-4 lists the top 25 processing services vendors in the U.S. by 1985 revenues. It also provides the CD ROM potential for these vendors on a 1 = very high, 4 = low scale. The ranking is based on a combination of true potential linked with the company's intention to use CD ROM.
- The overall picture is one of limited scope for CD ROM product penetration by processing services vendors. At present, the best processing services opportunity seems to be the combining of off-line historical search with on-line instant update of financial, commodities, stock, bond, and equity market data (i.e., Dow Jones/Datext).
- As the turnaround time for CD ROM data disk production decreases and the price for CD ROM drives drops, there will be greater incentives to examine CD ROM as a distribution mechanism. However, INPUT believes that by far the greater thrust will come from the fear of competition. If, for example, Dow Jones is very successful with the Dow Jones Newswire product, a rash of similar products will be forthcoming from ADP, McGraw-Hill, Quotron, etc.

EXHIBIT IV-4

LARGEST PROCESSING SERVICES VENDORS' CD ROM POTENTIAL

Revenue Rank 1985	COMPANY	CD ROM POTENTIAL*
1	Automatic Data Processing	3
2	Electronic Data Systems	3
3	Control Data Corporation	3
4	McDonnell Douglas Information Services	2
5	General Electric Information Services	2
6	Dun & Bradstreet - Business Information	1
7	Boeing Computer Services	3
8	Equifax, Inc.	2
9	Computer Sciences Corp.	3
10	Quotron Systems, Inc.	1
11	Dow Jones/Telerate	1
12	McGraw-Hill, Inc.	1
13	First Data Resources, Inc.	4
14	TRW Information Services	1
15	National Data Corporation	4
16	MTECH	4
17	Shared Medical Systems	3
18	International Business Machines (IBM)	3
19	Bank of America - Business Services	4
20	Mead Data Central	2
21	CCH Computax, Inc.	2
22	Bunker Ramo International Systems Division	2
23	Martin Marietta Data Systems	3
24	Fidata	4
25	GTE Corporation	4

* RATING: 1 = Very High, 2 = High, 3 = Medium, 4 = Low

Similarly, the introduction by McGraw-Hill of its series of CD ROM data bases will prompt Dun & Bradstreet to enter the market.

- It should not be concluded that the market for CD ROM products is, therefore, small in the processing services arena. All of the companies mentioned (Dow Jones, McGraw-Hill, Dun & Bradstreet, ADP, etc.) are \$1 billion plus in size and processing services customers number in the hundred of thousands-- enough to keep the CD ROM products vendors busy through 1988.

V SOFTWARE PRODUCTS VENDORS AND CD ROM

V SOFTWARE PRODUCTS VENDORS AND CD ROM

A. INTRODUCTION

- Due to the fluctuating status of CD ROM hardware standards, software vendors cannot be faulted for being cautious in their approach to developing systems software. Yet it is crucial that these building blocks be made available to application software developers if the CD ROM market is to take off. In the last six months hardware standards have begun to "gel" and so have a few (very few still) system software products.
- The special challenge faced by CD ROM systems software designers is to take into account the type of data (and indexed content) for which it is being written and the knowledge level and vocabulary of the user making the query. This is, of course, the traditional dilemma of systems software vendors--how to reconcile satisfying the widest range of system handling requirements while also remaining specific enough so as not to weigh the system down with large overhead or poor performance.
- As will be seen in the discussions that follow, systems and applications software developers are, so far, hard to tell apart, since if a vendor wishes to produce a CD ROM application today he must either adopt a (generalized) search/retrieval system software package from another vendor or write his own. In both cases, he will likely end up by customizing the package before proceeding to write a line of applications code. It is high time that a Micro-

soft or Digital Research (preferably both) produce CD ROM versions of their operating systems and that ORACLE, MICRORIM, Ashton-Tate, and ANSA produce CD ROM versions of their data base software.

B. LOTUS DEVELOPMENT CORPORATION

- Lotus Development has established a strategy to continue to add value to Lotus 1-2-3 by extending the sources of data that can be fed to 1-2-3 for processing/manipulation. It also calls for Lotus to "lead the industry in bringing advanced technology to personal computer users." To further that aim, Lotus aims to introduce complementary products that make the "anchor products" (1-2-3, Symphony, Jazz) more broadly applicable to "knowledge workers" in Fortune 2000 companies.
- CD ROM represents one such "complementary product" in which Lotus is strongly interested. Not only will the anchor products need to manage and access files stored on CD ROM, but some specific markets that Lotus has already entered have a need for CD ROM-based information. One such product, SIGNAL, is a hardware/software product that receives instantaneous financial quotations broadcast via FM sideband transmissions. SIGNAL works in tandem with 1-2-3 and Symphony. In a manner similar to Datext's CD ROM off-line access to historic data on financial quotes and public companies (complemented by Dow Jones' Newslite), SIGNAL will serve as the real time quote support for a CD ROM-based stock quotation trend analysis system (ONE SOURCE) that will use 1-2-3 to capture, store, and analyze the data from 20 years of stock price data stored on CD ROM. SIGNAL will provide the real time update to this analysis data. Prices range from \$11,000 to \$27,000 a year for weekly updates.
- Lotus will also make use of CD ROM for software and information distribution purposes (the ISIS bernoulli disks' capacity is already exceeded). Lotus will

not say the precise nature of its CD ROM product releases due for October 1986, but the extent of the announcements is sizeable according to company management.

- Just as significant is Lotus' Application Services Group, announced in August 1986, which provides on-site technical assistance to corporate customers developing personal computer applications products. This is the ideal support group for implementing CD ROM applications within Fortune 2000 companies. The group consists of full-time professionals who have had extensive experience developing and supporting Lotus products and who are kept up-to-date on Lotus product developments. This is the kind of systems/applications software mix that CD ROM needs to be successfully adopted into the market.

C. KNOWLEDGESET

- Perhaps the most well known CD ROM software developer at present is Knowledgeset which has made a concerted effort to establish itself as a leading supplier of search/access system software for CD ROM applications. Its most commercially successful effort to date has been the use by Grolier Publishing Inc. of its Knowledge Retrieval System^{T.M.} software to access the Electronic Encyclopedia.
- The product is a good example of a typical marriage between the software vendor community and information publishers. It is also a good example of:
 - The kind of development delays that will be common in bringing new CD ROM products to market--the Electronic Encyclopedia took 14 months to develop.

- A typical information content-based product. There are 141,387 unique words in the index (of 50 megabytes of index) representing nine million words or 20 volumes of encyclopedia.
- The way to retail CD ROM products--a PC-like network of dealers (currently 25) supply the product to the end-user market (largely libraries and schools).
- Exhibit V-1 shows KnowledgeSet's position with respect to:
 - Hardware vendors (Sony subsidiary Digital Audio, in particular, where a joint venture--Publishers Data Services--has been formed to provide the kind of application development services given to Grolier).
 - Grolier Publishing Inc., who jointly developed the Electronic Encyclopedia.

D. SOFTWARE VENDORS' CD ROM ACTIVITIES

- The CD ROM activity of software vendors has begun to heat up. For the most part, the commercial activity is incipient rather than developed, but the flow of products to the market can be expected to accelerate now that Lotus Development has made its ONE SOURCE announcement. Vendors such as Ashton-Tate and Microsoft can be expected to announce their initial offerings in early 1987.
- Exhibit V-2 summarizes the product activity of eight of the most significant PC software vendors in the U.S. With the exception of Ashton-Tate (who will only say that it is pursuing development of a CD ROM product for 1987 introduction) and IBM (who won't say anything, but is rumored to be preparing an educational product for fourth quarter 1986 introduction), most vendors have begun to put a toe in the water.

EXHIBIT V-1

KNOWLEDGESET'S VENDOR RELATIONSHIPS

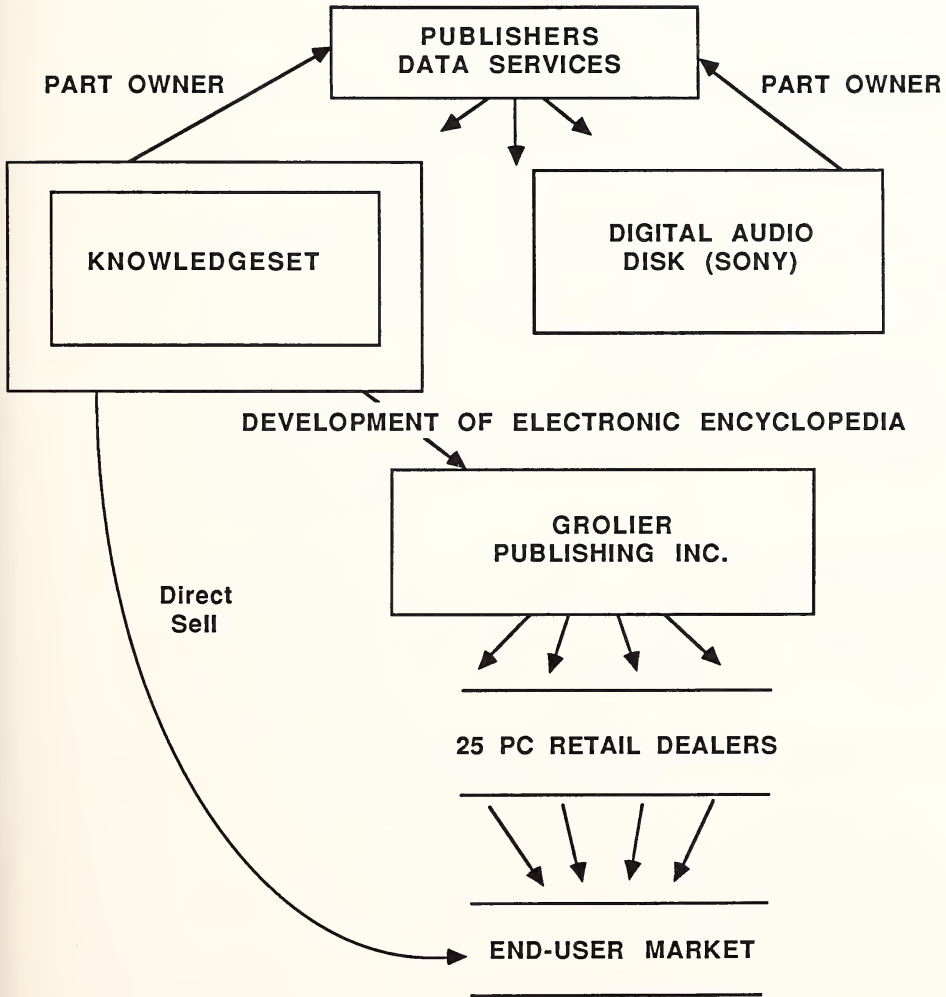


EXHIBIT V-2

SOFTWARE VENDOR CD ROM ACTIVITIES

COMPANY	STAGE OF DEVELOPMENT	PRODUCT(S)
Knowledgeset	Active	Custom Products, KRS
Borland	Active	Turbolightning/CD ROM
Ashton-Tate	Development	No Products
Reference Technology	Active	STAF/FILE
Microsoft	Development	Multimedia Demonstration
Lotus Development	Active	One Source <i>SR</i> <i>X</i>
PC Sig	Active	Software Publisher
IBM	Active	Educational Product for Q4, 1986?

- Borland has a CD ROM driver for its "Turbolightning" product library and thesaurus for use on an IBM PC. Borland also says it will purchase the rights to distribute information data bases that support CD ROM products.
- Reference Technology is one of the premier CD ROM applications developers offering a generic search/retrieval package called STAF/FILE (and STAF/KEY) and a full complement of applications services directed at the electronic publishing and information distribution markets.
- Microsoft has positioned itself as the market leader in CD ROM software development but has yet to prove itself worthy of the title. To date, products have been limited to the (excellent hardbound book "CD ROM: The New Papyrus" and an animated, multimedia demonstration at the most recent CD ROM conference. Nevertheless, since Microsoft has a separate division working on CD ROM development, we can expect to see some products in 1987.
- PC Sig is a software publisher with over 400 software titles. The company has begun offering the entire source code library of all of the titles on a CD ROM on a monthly update basis.
- Conspicuous by their absence are the big name data base management companies (Cullinet, CINCOM, Software AG, and Pansophic). To date none of them have shown evidence of CD ROM product development and perhaps rightly so since CD ROM is not a mainstream market for these vendors.

E. SOFTWARE VENDORS' CD ROM POTENTIAL

- Exhibit V-3 takes the largest software vendors by 1985 revenue and examines their potential, i.e., those software vendors who should have an interest in CD

EXHIBIT V-3

LARGEST SOFTWARE PRODUCTS COMPANIES' CD ROM POTENTIAL

Revenue Rank 1985	COMPANY	CD ROM POTENTIAL*
1	International Business Machines (IBM)	2
2	DEC	2
3	Lotus Development Corp.	1
4	Cullinet Software	3
5	Microsoft Corp.	1
6	Computer Associates International, Inc.	2
7	Management Science America	3
8	Tandy Corp.	3
9	Applied Data Research	2
10	Sperry Corp.	3
11	UCCEL Corp.	4
12	Ashton-Tate	1
13	Apple Computer	1
14	SAS	4
15	Prime Computerrs	3
16	Tandem Computers, Inc.	4
17	Hewlett-Packard	3
18	Data General Corp.	3
19	Wang	2
20	Information Builders	3
21	Pansophic Systems	3
22	Martin Marietta Data Systems	2
23	Honeywell	3
24	Sterling Software	2
25	TRW	3

* RATING: 1 = Very High, 2 = High, 3 = Medium, 4 = Low

ROM, irrespective of their current, actual plans. We have already discussed most of them, but a number of them still stand out.

- Out of the list, Apple Computer ought to have clearly defined, well known plans with regard to CD ROM at this stage. Unfortunately, this is not the case. The same applies to Microsoft, Computer Associates International, ADR, Wang, and Sterling Software.
- The absence, to date, of many of these and other companies from the CD ROM market has been severe (see Exhibit V-4). The fundamental building blocks for applications development are in short supply, in particular data base management software. Some of the skills needed for menu driven applications (software designers, applications specialists) are resident in these companies and are not being applied to CD ROM applications.

F. CD ROM IMPACT ON THE SOFTWARE PRODUCTS MARKET

- Enticing software vendors into the CD ROM market is currently a difficult proposition, since the skills required are rare and the rewards not yet obvious. For microcomputer software vendors (particularly system software suppliers) the attraction should be much higher than for minicomputer software vendors, and infinitely better than that for mainframe software vendors.
- INPUT expects fully 5% of all of the microcomputer software sales made in 1991 to be captured by products capable of reading CD ROM files and CD ROM-specific software products. This equates to over \$2.1 billion. Some of these dollars are for products whose principal purpose is not CD ROM search/retrieval, but that will need to have the CD ROM read option. By 1995 software product revenues from CD ROM-specific systems and applications will generate \$3 billion of new sales.
- Exhibit V-5 summarizes the main points.

EXHIBIT V-4

CD ROM SOFTWARE MARKET REQUIREMENTS

- **Software Building Blocks Are Needed:**
 - **Operating System, I/O**
 - **Data Base Management**
 - **Utilities/File Conversion**
- **Menu-driven Applications, with Specific User Profiles, Require Teaming of Software Specialists, System Designers and Applications Specialists**

EXHIBIT V-5

CD ROM IMPACT ON SOFTWARE PRODUCTS MARKET

- **Largest Opportunity Is in Microcomputer Software: 5% of All Micro Software in 1991 Will Need to Be Able to Handle CD ROM Files**
- **CD ROM Is First in Long Line of PC Optical Storage Media that Will Generate \$3 Billion of New Revenues by 1995**

VI TURNKEY SYSTEMS AND PROFESSIONAL SERVICES
VENDORS' ATTITUDES TOWARD CD ROM

VI TURNKEY SYSTEMS AND PROFESSIONAL SERVICES VENDORS' ATTITUDES TOWARD CD ROM

A. TURNKEY SYSTEMS VENDORS' CD ROM ACTIVITIES

- Turnkey system vendors stand on the threshold of a very exciting opportunity with CD ROM with \$800 million in annual sales by 1991. To date, however, very few have made serious headway in implementing CD ROM systems.
- Exhibit VI-1 summarizes the plans and activities of some of the major turnkey vendors and demonstrates the poor perception that most of them have of the opportunities open to them. Most have adopted a "wait and see" attitude. An example is Computer Consoles (which would benefit enormously from offering CD ROM-based telephone directory systems) who is "waiting for the users to request it." The danger is that one of the RBOC's can now offer a CD ROM-based competitive product for a third less.
- Other turnkey system vendors have made moves, however. Although they refuse to discuss their plans, EDS is rumored to be producing an Automobile Dealer Parts Catalog and Maintenance Manual turnkey system for the thousands of GM dealers and distributors. Reynolds and Reynolds is looking at a similar product.
- NCR has announced the prototyping of a Retail Catalog based on CD ROM, while SPCS plans to announce a "Disclosure-like financial data base system in

EXHIBIT VI-1

TURNKEY VENDOR CD ROM ACTIVITIES

COMPANY	STAGE OF DEVELOPMENT	PRODUCT(S)
Computer Consoles	No Plans	N/A
Daisy	No Plans	N/A
Reynolds & Reynolds	In Planning Stage	Not Announced
NCR	Prototype	Retail Catalogue
DEC	Announced	Micro VAX/VAX
Integrated Solutions	No Plans	N/A
Interactive Video	Announced	Full Motion Video
SPCS	Q4, 1986	Financial Data Base
Intergraph	No Plans	N/A
EDS	Prototype	Automobile Dealer Parts Catalog
PRC	Announced	U.S.Patent File

the fourth quarter of 1986. DEC, the SPCS partner in this service, had originally offered subscriptions to 12 different CD ROM subscription files as a publisher.

B. TURNKEY SYSTEMS VENDORS' CD ROM POTENTIAL

- Based on their ability to leverage CD ROM technology in their present product lines and markets, Exhibit VI-2 classifies the top 25 turnkey system vendors (in 1985 U.S. revenues).
- All of the CAD/CAM vendors should be able to provide CD ROM storage options to their automated design systems. The only limitations are those vendors whose principal activities are for customized turnkey systems or applications based on transitory data sets.
- The real potential, however, lies in new applications. Computer Consoles, for example, that offers its customers ways to sell their subscriber lists to outside firms could easily package a CD ROM/PC combination that leverages a subscription to such data. It is the ideal application--semi-permanent data and many users.
- It is likely, therefore, that given the inertia of existing turnkey vendors and the very high potential in the marketplace, the winners in the CD ROM arena will be newcomers and start-ups who focus on a single vertical market segment.
- Turnkey vendors must, therefore, watch out for successful start-ups who gain a strong presence in vertical markets that have relevance to their own strategic thrust. Acquisition of successful newcomers could turn out to be the lowest risk option for entering the CD ROM market.

EXHIBIT VI-2

LARGEST TURNKEY SYSTEMS VENDORS' CD ROM POTENTIAL

REVENUE RANK 1985	COMPANY	CD ROM POTENTIAL*
1	Intergraph Corporation	1
2	Computervision Corporation	1
3	Gerber Scientific	3
4	Calma Company	1
5	HBO & Company	3
6	Ultimate Corp. (The)	3
7	Daisy Systems	4
8	Shared Medical Systems	2
9	Reynolds & Reynolds	2
10	Applicon	1
11	McDonnell Douglas Information Services	2
12	Computer Consoles	1
13	Triad Systems Corporation	3
14	C3	4
15	Auto-trol Technology Corp.	2
16	Sterling Software	3
17	ASK Computer Systems, Inc.	3
18	Lockheed (Metier)	2
19	Control Data Corp.	2
20	General Instruments	4
21	Redshaw	4
22	Planning Research Corp.	3
23	Evans & Sutherland	3
24	SymBolics	4
25	United Telecommunications, Inc.	4

Rating: 1 = Very High; 2 = High; 3 = Medium; 4 = Low

- In addition, turnkey vendors must examine the multi-media CD ROM opportunities that exist in markets they already serve; this is the safest way to gain internal CD ROM experience while enhancing current market sales.

C. CD ROM IMPACT ON TURNKEY SYSTEMS

- The market take-off phase of CD ROM products and services lies ahead in the 1987-1990 timeframe, so turnkey system vendors should pay more attention to potential rather than current market sizes, current vendor activity, current products available, etc.
- CD ROM is a clear opportunity to expand current products in current markets by adding additional distribution/publishing options where appropriate and to enter new markets that leverage information owned or controlled by the turnkey system vendor. CD ROM's advantages and applications are simple--provide random, read-only access to semi-permanent data on a subscription basis. It should also be a simple task for each turnkey system vendor to ascertain where and whether CD ROM applies to the systems and markets that are within its principal strategic thrust.
- The principal difficulty in exploiting many of these opportunities lies not in the drawbacks of the technology but in the lack of specialist knowledge of narrow vertical markets needed to adequately design and market CD ROM-based products. With CD ROM, knowledge of the information process used in a particular market is not enough; a detailed understanding of the vocabulary, thought processes, and needs of the particular professional user targeted is mandatory.
- Exhibit VI-3 summarizes the main points.

EXHIBIT VI-3

CD ROM IMPACT ON TURNKEY SYSTEMS

- **Barrier to Growth Is Specialist Knowledge of 3rd Level SIC Markets**
- **New Opportunities That Expand Current Markets, Add New Markets**
- **CD ROM Manufacturers Will Look to Sign-up Dealers/Distributors with Software/Applications Expertise**

D. PROFESSIONAL SERVICES VENDORS' CD ROM POTENTIAL

- Exhibit VI-4 examines the CD ROM potential of the 25 largest U.S. professional services vendors classified according to 1985 revenues. The greatest potential lies with those companies who must provide technological leadership, namely IBM, CSC, Arthur Andersen, and EDS.
- Close behind are the companies that have the opportunity to leverage some of the CD ROM developments they are involved in or associated with, e.g., McGraw-Hill, Battelle, Burroughs, etc.
- The largest potential CD ROM market for professional services vendors lies in customized software development for CD ROM applications in Fortune 1000 companies. Systems design knowledge in vertical markets will be key, associated with the willingness to accept fixed fee development contracts. It is likely that much of the business will come from including CD ROM as a storage device in a system whose central role is not the exploitation of CD ROM files.
- CD ROM professional services is and will remain a small market, reaching less than 1% of the \$32 billion professional services market by 1991. However, optical storage systems design will rapidly become a large market and a very specialized one. There are no such specialists on the market today outside of the hardware manufacturers, so the opportunity remains open.

EXHIBIT VI-4

LARGEST PROFESSIONAL SERVICES VENDORS' CD ROM POTENTIAL

REVENUE RANK 1985	COMPANY	CD ROM POTENTIAL *
1	International Business Machines (IBM)	1
2	Computer Sciences Corporation	1
3	Arthur Andersen & Company	1
4	Peat, Marwick & Mitchell	2
5	Burroughs Corporation	2
6	EDS	1
7	Logicon	3
8	Mitre Corporation	2
9	McGraw-Hill	2
10	Price-Waterhouse	4
11	Bolt Beranek & Newman	3
12	Planning Research Corporation	3
13	AGS Computers	3
14	Computer Task Group	3
15	TRW Information Services	2
16	CACI Inc.	3
17	Syscon Corporation	3
18	CAP Gemini America	3
19	DBA Systems, Inc.	3
20	GEISCO	3
21	Grumman Data Systems	4
22	McDonnell Douglas Information Services	3
23	Boeing Computer Services	2
24	Battelle Memorial Institute	2
25	Arthur D. Little	4

* RATING: 1 = Very High, 2 = High, 3 = Medium, 4 = Low

VII CD ROM OPPORTUNITIES FOR INFORMATION
SERVICES VENDORS

VII CD ROM OPPORTUNITIES FOR INFORMATION SERVICES VENDORS

A. ABSORBING CD ROM INTO CURRENT SERVICES

- INPUT believes that the best way to approach CD ROM and its potential uses is to review products and services for CD ROM characteristics (semi-permanent data applications, large file ownership, focused vertical market services) and review the advantages and disadvantages of CD ROM use in that context.
- CD ROM will not convert a poorly focused service into a smash hit. However, it is better to view CD ROM as a supplementary distribution media and a tool for information access and manipulation than as a magic wand for converting a dying service into a "new" product.
- This is precisely the approach of the publishers who are offering CD ROM versions of their printed products to their regular customer base. Essentially, they are proposing a random access option to the regular (batch access) printed catalog/reference manual. In most cases, the main advantage is speed of access to a given set of information, ease of distribution, and compactness of the product. For example, it is faster (and cheaper) for an aircraft manufacturer to send quarterly copies of a CD ROM disk containing the latest edition of an aircraft's maintenance manuals than to ship an eight foot high stack of paper weighing (literally) a ton. It is also quicker for the maintenance technician to access the information he needs.

- Evolution, rather than revolution, should therefore be the guideline for CD ROM's use in information services. This is the wrong time, in a market that is growing increasingly competitive, for vendors to take their eyes off of their main purpose in life and the goals they have set for themselves as a company. It is also the wrong time in CD ROM's (and other optical storage products') evolution to put all of your one's eggs in the optical storage basket. The technology, pricing, performance, and standards will all evolve rapidly over the next two years.
- This does not mean that it is too early to make use of CD ROM--to do so would be to lose time in educating the company and its customers in the use of optical storage, which is an inevitable storage evolution. However, the only sensible approach (in 1986) is to have a smooth transition of service and distribution media. In 1988 the urgency will be more acute--by then vendors who have no CD ROM experience will be faced with a starker choice.

B. IMPACT OF CD ROM ON COMPUTER OUTPUT MICROFILM

- Perhaps the most immediate and significant impact of CD ROM in the information services area is on computer output microfilm (COM) services. Not only does CD ROM have a price advantage and a performance advantage, it also beats COM in ease of use, ease of distribution, and ease of manipulation of the retrieved data (which is a serious drawback in all COM applications).
- The only barrier to CD ROM penetration of COM markets is the investment (sometimes substantial) that users have made in COM equipment. Again, the best approach is evolution--putting a PC/CD ROM package alongside the COM equipment. This is already happening with publishers who are COM users, but has not happened with the biggest COM customers--banks--primarily because of the need for document (not information) capture.

- This limitation (lack of an easy way to digitally capture images) will soon disappear. Images can be created on a PC screen and stored/recalled, but "photographing" an image on CD ROM is not easy. As it becomes available, COM services will be in real danger.

C. MULTIMEDIA CAPABILITIES

- Without a doubt, the multimedia capabilities of CD ROM represent an enormous opportunity in terms of market potential. Converting that potential to commercial market revenue is another thing altogether (see Exhibit VII-1).
- This is principally due to the fact that the multimedia skills needed to fully exploit the potential are very scarce. It is one thing to transfer an existing digital file to CD ROM media and front-end the storage with application software. It is another to conceptualize how sound, image, text, and data can harmoniously co-exist on that same medium and be successfully exploited by the front-end software.
- This is being partially achieved by assigning roles to the different media:
 - Voice-over commentary provides helpful comments as guidance as to "what to do next" when the user is faced with error messages, menus, or options.
 - Images summarizing results, concepts, pathways, etc. provide a "bird's eye view" of progress to date.
- Educational systems are the best example of "voice-over commentary" use and dictionaries are the best example of images with text. In general, these dual media applications are not too difficult to achieve.

EXHIBIT VII-1

MULTIMEDIA CAPABILITIES

- **The Most Explosive Potential Offered by CD ROM**
- **Realistically a Small Opportunity for Now: No Established Expertise, Very Costly**
- **Some Scope for Text/Data, Image/Menus with Sound-Over**
- **Best Market: Educational Tools**

- True multimedia integration is another matter, as was demonstrated by Microsoft's production of the animated DNA molecule on CD ROM. In the process of producing it, Microsoft learned a lot about multimedia CD ROM products. In particular:
 - It requires totally different skills from those needed to produce computer software.
 - It is important to keep the skills separate--programmers, audio and visual people--all have a single "genius" to pull it together.
 - It requires, like a TV/film production, a storyboard and script, with successive levels of simulation--paper story, computer story with basic images, story flow with better images, animated flow, etc.
 - It is very expensive.
- Nevertheless, despite the difficulties of managing a project whose many different skills intersect, the effect can be stunning. Many people bought the system on sight, just to be able to demonstrate the capabilities to their own people (Microsoft says it sold 25-30 such systems). In addition, most of the tools needed for such a production exist (Qantel paint box, TV studio, etc.), but Microsoft found itself developing its own vocabulary to describe what it was doing.
- For the moment, however, such combinations of skills are rare indeed, and it is unlikely that they will proliferate. It is more probable that "production shops" will be set up that do have the skill combinations required and operate on a project basis for vendors requiring the development of multimedia products.

D. CD ROM INFORMATION SERVICES, 1986-1991

- CD ROM markets, including the sales of CD ROM drives, data disks, mastering/data transfer services, and subscriptions to CD ROM "editions" of disks (generally speaking, annual subscriptions to a once-a-quarter issue of a CD ROM "publication" or data disk, allied with a systems leasing fee) will generate sizeable revenues by 1991.
 - Today (1986), sales are slow, revenues are tiny, and most commercial products are in the prototype stage. It is not appropriate to talk about the market in any detail (e.g., market share of major vendors, etc.).
 - By 1988 the market will begin its surge (see Exhibit VII-2) and will grow rapidly thereafter, more than doubling each year through 1990.
 - By the end of the forecast period, the CD ROM market will approach \$1 billion in yearly sales, no small opportunity.
- For information services vendors, the impact of CD ROM is far more substantial. Like most markets, the ratio of software and services sales to hardware sales is two to one in favor of the former. In other words, the hardware sales represent approximately 30% of the total CD ROM market. By 1991 the market for CD ROM-based information services will exceed \$2 billion in yearly sales (see Exhibit VII-3).
- The largest share of this will go to turnkey systems (\$800 million) where the potential for vertical market-specific solutions or workstations is enormous. The second largest is, of course, software products combining:
 - Releases of existing products, modified to accommodate CD ROM input/output and file management.

CD ROM MARKETS, 1986-1991

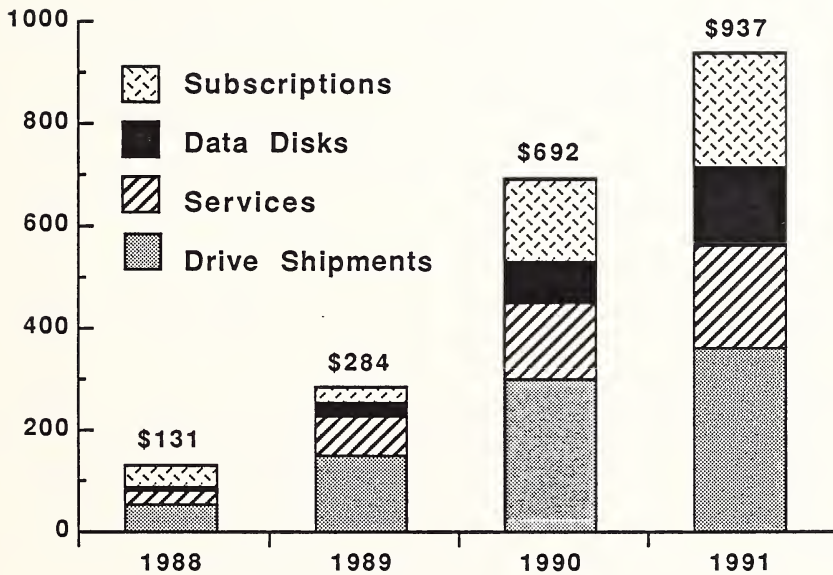


EXHIBIT VII-3

NET IMPACT OF CD ROM ON INFORMATION SERVICES

SERVICE DELIVERY MODE	NET IMPACT (\$ M)	
	1986	1991
Processing/Network Services	*	\$425
Software Products	*	610
Turnkey Systems	*	800
Professional Services	*	265
Total	(Small)	\$2100

- CD ROM utilities and generic search/retrieval software.
 - Application-specific packages and customized software developments.
 - The markets for processing/network services and professional services are much smaller but not by any means negligible.
- It must be remembered that by 1989, all three of the main optical storage technologies (CD ROM, WORM, and read/write) will be commercially implemented. It is likely that some of the software drives, turnkey systems, etc. will be able to make use of more than one or a mix of these technologies. The total market for all of these technologies together is speculative but could be as high as \$3 billion in yearly revenues to information services vendors.

E. CONCLUSIONS

- CD ROM is poised on the edge of its market development and must, to proceed, receive the same kind of software support that transformed the PC from a garage shop product to a fully blown industry. The PC market is also the main opportunity for CD ROM applications. A PC/CD ROM combination is a powerful and inexpensive tool. However, since the CD ROM drive interface is compatible with SSCI, minicomputer connection is also a possibility.
- To really develop a market, there must be either the fear of losing market share or the prospect of significant profit. At the moment, most information services vendors are not motivated by either event. Therefore, the best thing that could happen to the market is for one visible account (preferably a publisher) to be very successful in using CD ROM. As soon as that happens, there will be a rush to join the bandwagon (publishers are like bankers,

gregarious in nature). The most likely candidate for this early success is McGraw-Hill.

- Exhibit VII-4 summarizes the main points.

EXHIBIT VII-4

CONCLUSIONS

- **CD ROM Needs the Same "Creative Explosion" Support as the PC to Achieve Its Full Potential. Without It, CD ROM Will Languish.**
- **CD ROM Is First in a Long Line of Optical Storage Products that May Ultimately Replace Magnetic Storage.**
- **Fear and/or Greed Factor Is Missing So Far.**
- **The Best Thing that could Happen to the Market Is for One Large User Company to Be Very Successful in Implementing CD ROM.**

APPENDIX A: FORECAST DATA BASE

APPENDIX A: FORECAST DATA BASE

- The following forecasts, shown in Exhibits A-1 and A-2, provide year-by-year data on the size and growth of the CD ROM market divided into:
 - Net CD ROM information services markets by delivery mode.
 - Net CD ROM information services markets by application.

EXHIBIT A-1

NET CD ROM INFORMATION SERVICES MARKETS
BY DELIVERY MODE
(\$ Millions)

DELIVERY MODE	1986	1987	1988	1989	1990	1991	AAGR
Processing/Network Services	1	5	17	54	210	425	250%
Software Products	1	3	12	39	120	610	260%
Turnkey Systems	3	8	24	80	265	800	206%
Professional Services	0	1	3	14	32	265	N/A
Total	\$5	\$17	\$56	\$187	\$627	\$2100	235%

EXHIBIT A-2

NET CD ROM INFORMATION SERVICES MARKETS
BY MAJOR APPLICATIONS
(\$ Millions)

MAJOR APPLICATION	1986	1987	1988	1989	1990	1991	AAGR
Publishing/News	3	8	21	67	230	520	180%
Libraries	1	2	4	10	65	145	171%
Legal	0	0	1	4	19	90	N/A
Medical	0	1	4	14	40	130	N/A
Securities/Financial	1	4	12	40	95	280	209%
Credit	0	1	5	13	35	125	N/A
Demographic/Resouces	0	0	1	3	15	65	N/A
Real Estate	0	0	2	10	38	120	N/A
Econometric	0	0	1	8	26	70	N/A
Education	0	1	3	9	30	120	N/A
Other	0	0	2	9	34	435	N/A
Total	\$5	\$17	\$56	\$187	\$627	\$2100	235%

APPENDIX B: QUESTIONNAIRE

CD ROM VENDOR QUESTIONNAIRE
=====

CD ROM has begun to emerge as one of the most exciting storage technologies since the Winchester disk. In addition it has very broad applicability to Information Services and products, in some cases complementary, in others with the potential for replacement of current products and services. INPUT is conducting research to examine the impact of CD ROM on Information Services markets and we'd like to hear how you plan to deal with its potential and challenge. Are you familiar with CD ROM ? If not, who is the best person to talk to in your organisation ?.....

1. Does your company consider CD ROM to be :

- an opportunity ?.....(If so, in which market area/s.....
.....
.....)
(If not, why not?.....
.....)
- a threat to current and/or future products and services ?.....(If so, which products and services ?.....
.....)
(if not, why not ?.....
.....)

2. Is your company's posture towards CD ROM :

- Offensive
- Defensive

3. The success of a CD ROM product lies in its ability to target a focused group of users that have a common set of needs. Which applications do you see as having the greatest opportunity for your company ?.....
.....
.....

4. Frequently a CD ROM application is based on the existence of a body of non-volatile data. Does your company own this kind of data or will you seek to enter into partnership arrangements with information suppliers ?.....
.....
.....
(Name of the partner.....)
5. As a (RCS/SW/TK/com/OLDB/PS) vendor, how do you see CD ROM impacting the market in general ?.....
.....
.....
6. Who , in your end of the market, do you think stands to benefit the most from the introduction of CD ROM ?.....
.....
.....
7. In your opinion, what is the best strategy for handling CD ROM given the absence of standards and the undeveloped stage of the market so far ?.....
.....
.....
8. Does the absence of IBM and knowledge of which direction they will take influence your attitude towards CD ROM at present ?.....
In whatway ?.....
.....

9. Many hardware manufacturers (e.g. DEC, NCR, XEROX, SONY) are moving strongly into the CD ROM market for software, turnkey sytems and professional services. Does this concern you ?.....
 Why/why not.....

10. CD ROM's weaknesses have been well documented. For example the inability to write/erase/update data, the long production cycle for the production of master disks, the relatively slow access times etc. Which ,if any ,of these concerns you most ?.....

11. In your opinion, by what percentage will CD ROM impact, if at all, your company's revenue in the following period :

	Year	Percent	+/-
-	1986
-	1987
-	to 1991

12. Who are , in your opinion, the top three CD ROM manufacturers most likely to survive in this market ?

13. And who will be the top three Information Services winners in the CD ROM market ?.....

THANKYOU FOR YOUR TIME !!!

